THE JOURNAL OF RADIO RESEARCH & PROGRESS

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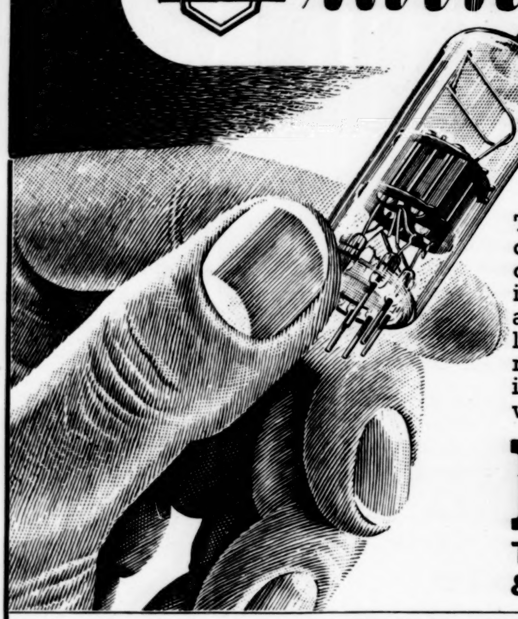

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		(V)	(A)	(V)	(V)	(V)	(mA)	(mA/V)		(KΩ)	Ω	KΩ	(W)
EY91	Half-Wave Rectifier	6·3	0·42	250 (max)	—	—	75 (max)	—	—	—	—	—	—
EC91	V.H.F. Grounded-grid Triode	6·3	0·3	250	—	–1·5	10	8·5	100	12	150	—	—
EF92	V.M., R.F. or I.F. Pentode	6·3	0·2	250	150	–0·65	8	2·5	—	—	—	—	—
EF91	High Slope, Sharp Cut-off Pentode	6·3	0·3	250	250	–2	10	7·65	70 (g1-g2)	1000	—	—	—
EAC91	Diode Triode for Frequency Changing up to 300Mc/s	6·3	0·3	200	—	–2·8	7·5	2·8	36	12·8	—	—	—
EB91	Screened Double Diode—separate Cathodes	6·3	0·3	150 (max)	—	—	9·0 (max)	—	—	—	—	—	—
EL91	Output Pentode (1·4W Output)	6·3	0·2	250	250	—	16	2·6	12 (g1-g2)	130	680	16	1·4
ECC91	Double Triode (Physical Common Cathode)	6·3	0·45	100	—	—	8·5	5·3	38	7.1	100	—	—
DK91	V.M. Frequency Changer	1·4	0·05	90	45	0	0·8	0·25 (gc)	—	800	—	—	—
DF91	V.M., R.F. or I.F. Pentode	1·4	0·05	90	45	0	1·8	0·75	—	800	—	—	—
DAF91	Single Diode Pentode	1·4	0·05	67·5	67·5	0	1·6	0·625	—	600	—	—	—
DL92	Output Pentode (0·27W Output)	1·4	0·1	90	67·5	–7	7·4	1·58	—	100	—	8	0.27
DL93	Output Pentode	1·4	0·2	150	90	–8·4	13·3	1·9	—	100	—	8	0·7

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Vol. XXV DECEMBER 1948 No. 305

Relatively-moving Charge and Coil

IN our September Editorial we considered some problems raised by Professor Cullwick and in this number we publish a letter in which he discusses some of the points raised therein. He agrees that the e.m.f. induced in the coil should depend solely on the relative velocity of the coil and charge and not on which of the two one regards as moving and which at rest, and yet he finds difficulties in applying classical theory to the case of the stationary charge and moving coil; that is, as the phenomenon appears to an observer on the charge. In our opinion, his difficulties are largely due to a misconception of the nature of the electrostatic charges induced on the ring of wire as it approaches and recedes from the stationary charge.

His Fig. 1 is correct but his Fig. 2 is quite fallacious. He says that 'if the coil is a single loop of thin wire, negative charges will be induced on the outer surface in the neighbourhood of A, and positive charges on the inner surface.' This is quite wrong, as can be seen from our Fig. 1 in which a ring of wire is situated between two conducting surfaces, of which the upper is charged positively and the lower negatively. Lines of force will leave the upper conductor as shown and end on negative charges on the ring. These induced negative charges will be concentrated towards the upper outside of the ring but will be distributed to some extent over the whole upper half of the ring as shown. The positive charges do not retreat to the inside of the ring but to the lower half. In Professor Cullwick's case the arrangement is not so symmetrical but the distribution is roughly the same; that is a negative charge on the surface of the ring in the neighbourhood of the stationary positive charge and a positive charge distributed over the more distant parts of the ring's surface, as we explained in the Editorial. The distribution is, of course, such that all parts of the ring are at the same potential. Consequently no line of electric force can go from one part of the ring to another part. We emphasise this because we suspect that Professor Cullwick pictured lines crossing the space inside the ring between his internal charges.

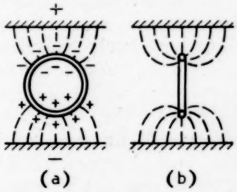
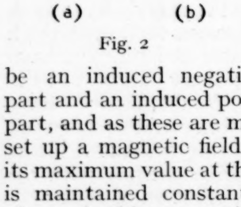


Fig. 1

To an observer on the stationary charge these induced charges are moving with the ring and act as current elements, setting up a magnetic field. This magnetic field will be a maximum through the ring at the moment of nearest approach to the stationary charge. A moment ago there was no magnetic flux through the ring and a moment later the ring will have moved away from the stationary charge and the flux will again be zero. Would Maxwell have agreed that this magnetic flux could be smuggled somehow in and out of the ring without inducing an e.m.f. in it? We disagree entirely with the statement that a logical application of Maxwell's equations seems to show that no e.m.f. is induced by the surface charges. In our opinion there is no inconsistency to be resolved by an application of Einstein's theory.

Professor Cullwick then propounds another problem in which a charge is moving along the axis of a closed toroidal coil, but we must confess that we cannot follow his argument. With reference to his Fig. 4 he says, 'the induced current as it grows will induce an electric field along the axis of the toroid in the direction of motion of Q,' but the changing magnetic flux in the toroid not only induces an e.m.f. in the wire but also in the surrounding space, and it is difficult to see how the induced electric field along the axis can be in opposition to E as he infers. The electrostatic forces will certainly accelerate the moving element as it approaches and retard it as it recedes. If the resistance of the toroid is negligible no appreciable magnetic flux will be able to penetrate it, a negligibly small induced e.m.f. sufficing to produce the current necessary to maintain the resultant flux at zero.

Professor Cullwick also discusses the peculiar case in which the current in the toroid is maintained constant by some external source. In this case the magnetic flux due to the moving charge is simply superimposed upon that of the constant current, the induced e.m.f. being counterbalanced by variation of the externally applied voltage. This involves the supply or withdrawal of energy by the external source. Professor Cullwick states that as Q moves along the axis of the coil it experiences no magnetic or induced force whatever, whereas it exerts a magnetic force of repulsion on the toroid. He does not give his reasons for these conclusions, and one cannot help wondering if the apparent anomalies are due to some fallacy in the treatment of the problem.



(a) (b)

Fig. 2

It is an easy matter to overlook some little detail in such complex problems. As an example we will take the case of the positive charge Q at rest and the toroid approaching it as shown in Fig. 2 (a). At the moment that the toroid passes the charge, as shown in Fig. 2 (b), there will be an induced negative charge on the inner part and an induced positive charge on the outer part, and as these are moving to the left they will set up a magnetic field as shown, which reaches its maximum value at this moment. If the current is maintained constant by an external source of e.m.f. this magnetic field will grow as the toroid approaches and decrease as it recedes without experiencing any opposing m.m.f. As the toroid approaches, the growing magnetic flux will induce an e.m.f. in the direction shown in any closed path linking the toroid. The externally adjusted voltage applied to the coil may prevent this induced e.m.f. affecting the current in the coil but it does not affect the induced e.m.f. in the surrounding space. The charge Q being at rest has only an electric field and this electric field will be distorted by the electric field induced by the changing flux. The direction of the induced field at Q is such as to repel it, but the induced electric field will also distort the electric field of Q in the neighbourhood of the toroid. The distorted electric field will exert a lateral pressure on the toroid tending to oppose its motion. In other words, the distortion of the electric field by the increasing magnetic flux produces a repellent force between the charge and the toroid. When the toroid has passed the charge the magnetic flux decreases, the induced e.m.f. is reversed and the force is still repellent; it thus always acts in opposition to the attractive electrostatic forces. To an observer on the coil the charge is moving and his description of the phenomena would be somewhat different, but any measurable quantity must surely be the same.

Fig. 3 may help to explain the nature of the force of repulsion between the charge and the toroid. This figure may represent two entirely different phenomena. It may represent the cross-section of a conductor carrying current towards the reader in a magnetic field, which is distorted as shown by the magnetic force due to the current. It may, however, represent an electric field in which the dots indicate a magnetic flux towards the reader. If this magnetic flux is decreasing it will induce an electric field left-handedly around it which will distort the original electric field as shown. Superimposed on this will be fields due to electric charges on conductors, but these present no difficulties. Just as the mechanical forces of repulsion in the magnetic case are transmitted to the body of the magnet and to the conductor, so in the electric case the force will be transmitted to the charge Q from which the electric field emanates and to the toroid which causes the distortion. The moral of all this is that, on discovering apparent anomalies in the application of classical theory to electromagnetic problems, one should not invoke Einstein or Ritz but examine very carefully one's fundamental concepts and their application.

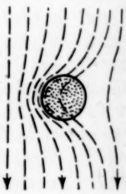


Fig. 3

We trust that these remarks will have thrown some light on what is undoubtedly a very intriguing problem.

G.W.O.H.

ANALYSIS OF BRIDGE-TYPE VALVE VOLTMETERS

By P. Popper, B.Sc., and G. White, B.Sc.

SUMMARY.—An analysis is made of four arrangements of the bridge-type valve voltmeter, and a comparison is made from the point of view of sensitivity and h.t. stability. While in the case of a single-valve circuit, transference of the resistor from anode to cathode lead offers some advantages with respect to stability and linearity, this is not the case in the two-valve circuit. For the latter, a solution for non-linear operation is given.

1. Introduction

WHEN a valve is used for the measurement of direct voltages, it is desirable to balance out in some manner the steady component of anode current since this allows the use of a more sensitive output meter, and also the whole of the scale becomes available for the indication of the input voltage. One method of achieving this is to make the valve and its associated resistors form two of the arms of a Wheatstone bridge. The other two arms are formed either by two resistors or by a similar valve and resistor. These two types of bridge amplifier can be further subdivided according as the valve resistor is placed in the anode or cathode circuit.

Various claims have appeared in recent literature regarding the advantages of placing the valve resistor in the cathode circuit, and of using two valves, but no comprehensive comparison of the four types of amplifier has yet been made.

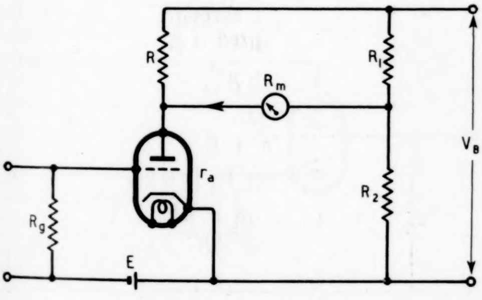


Fig. 1. *Single-valve circuit with anode resistor.*

It is the purpose of this paper to compare the four types of amplifier from the point of view of sensitivity, stability, and linearity, and to find how the choice of the output meter affects the performance of these circuits.

MS accepted by the Editor, July 1947.

2. Type I.—One Valve; Anode Resistor

Fig. 1 shows a single-valve bridge amplifier in which the valve resistor is placed in the anode circuit, and the output meter is connected between anode and a tap on the potential divider R_1R_2.

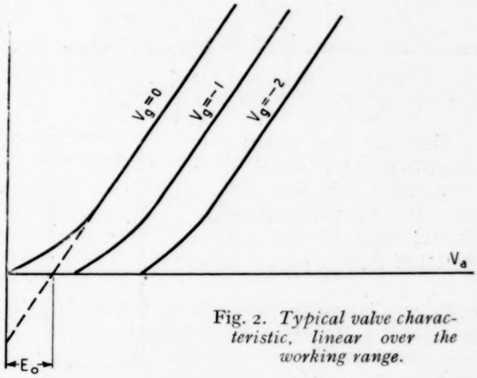


Fig. 2. *Typical valve characteristic, linear over the working range.*

Now if the valve characteristics are assumed to be straight and parallel to each other over the working range, as shown in Fig. 2, the anode current is given by

$$I_a = \frac{V_a + \mu V_g - E_0}{r_a} \quad \ldots \quad \ldots \quad (1)$$

where I_a, V_a, r_a, V_g and μ have the usual significance, and E_0 is the intercept on the V_a axis made by the tangent to the $V_g = 0$ curve.

$$\text{Thus } V_a = r_aI_a + (E_0 - \mu V_g) \quad \ldots \quad \ldots \quad (2)$$

This indicates that the valve can be replaced by an equivalent circuit consisting of a resistor r_a in series with an e.m.f. given by $E_0 - \mu V_g$. Fig. 3, therefore, represents the equivalent circuit of the arrangement of Fig. 1, provided the meter is omitted.

The open circuit voltage between A and B is given by

$$V_{\mathrm{B}}\frac{R_2}{R_1+R_2} - \left\{E_0 - \mu V_g + \frac{r_a}{R+r_a}(V_{\mathrm{B}} - E_0 + \mu V_g)\right\}$$

It follows from Thévenin's theorem that the current flowing through the meter of resistance R_m when the latter is connected between A and B, is given by

$$I_m = \frac{V_{\mathrm{B}}\dfrac{R_2}{R_1+R_2} - \left\{E_0 - \mu V_g + \dfrac{r_a}{R+r_a}(V_{\mathrm{B}} - E_0 + \mu V_g)\right\}}{\dfrac{Rr_a}{R+r_a} + \dfrac{R_1R_2}{R_1+R_2} + R_m}$$

which, when re-arranged, gives

$$I_m = \frac{\mu V_g R - E_0 R + V_{\mathrm{B}}\left(\dfrac{RR_2 - r_aR_1}{R_1+R_2}\right)}{Rr_a + (R+r_a)\left(R_m + \dfrac{R_1R_2}{R_1+R_2}\right)} \qquad (3)$$

If V_i is the input voltage

$$V_i - E = V_g \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

and if the circuit is to be balanced when $V_i = 0$

$$V_{\mathrm{B}}\left(\frac{RR_2 - r_aR_1}{R_1+R_2}\right) = R(E_0 + \mu E) \quad \ldots \quad (5)$$

This is the balance condition and since it contains V_{B} the zero will not be independent of fluctuations in the h.t. voltage.

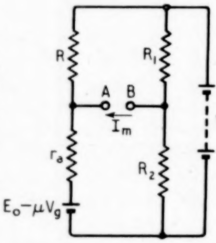


Fig. 3. *Equivalent circuit of Fig. 1 with the meter omitted.*

The sensitivity is given by

$$\frac{\partial I_m}{\partial V_i} = \frac{\mu R}{Rr_a + (R+r_a)\left(R_m + \dfrac{R_1R_2}{R_1+R_2}\right)} \quad \ldots \quad (6)$$

Also when the circuit is balanced for $V_i = 0$ (i.e., substituting from (5))

$$\frac{\partial I_m}{\partial V_{\mathrm{B}}} = \frac{R(E_0 + \mu E)/V_{\mathrm{B}}}{Rr_a + (R+r_a)\left(R_m + \dfrac{R_1R_2}{R_1+R_2}\right)} \quad \ldots \quad (7)$$

From (6) and (7) we get

$$\sigma = -\frac{\partial I_m/\partial V_i}{\partial I_m \partial/V_{\mathrm{B}}} = \left(\frac{\partial V_{\mathrm{B}}}{\partial V_i}\right)_{I_m\,\mathrm{const}} = -\frac{\mu V_{\mathrm{B}}}{E_0 + \mu E} \quad \ldots \quad (8)$$

σ is a measure of the h.t. stability of the circuit since it gives the variation ∂V_{B} of h.t. voltage which is equivalent in its effect on the meter current to unit variation ∂V_i in the input voltage. For good stability σ should be large. No real advantage is gained by increasing V_{B}, since the fluctuations will be proportionately larger. There remains the factor $\dfrac{\mu}{E_0 + \mu E}$ which should be as large as possible for good stability. When $RR_2 = R_1r_a$ and $E_0 = -\mu E$ the balance condition becomes independent of V_{B} and the stability σ infinite. The condition $E_0 = -\mu E$ implies that the tangent to the $V_g = 0$ anode characteristic shall cut the V_a axis at $-\mu E$. In the special case when $E = 0$, E_0 must also be zero, and Nottingham[1] has shown that the condition $E_0 = 0$ can be satisfied by operating the valve in a region where saturation begins to show.

It should be noted however that the above analysis holds only when the valve is operated over the linear portion of its characteristic.

3. Type II.—One Valve; Cathode Resistor

Fig. 4 shows a single-valve bridge amplifier in which the valve is used in the cathode-follower connection, and the meter is connected between cathode and a tap on the potential divider R_1R_2. Proceeding as before it will be seen that the equivalent circuit is as shown in Fig. 5.

The current flowing through the valve when the meter is open-circuited is given by

$$I_a = \frac{V_{\mathrm{B}} - E_0 + \mu V_g}{R + r_a}$$

where $V_g = V_i - I_aR + E$

and on substituting for V_g it will be found that

$$I_a = \frac{V_{\mathrm{B}} - E_0 + \mu E + \mu V_i}{r_a + (\mu + 1)R} \quad \ldots \quad \ldots \quad (9)$$

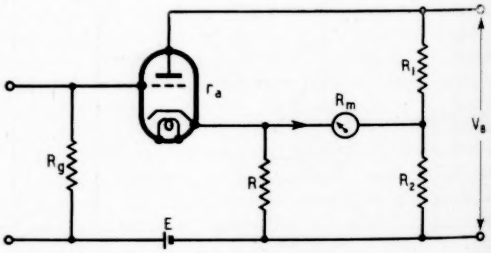


Fig. 4. *Single-valve circuit with cathode resistor.*

Thus the open-circuit voltage between A and B is

$$\frac{V_{\mathrm{B}} - E_0 + \mu E + \mu V_i}{r_a + (\mu + 1)R}R - \frac{R_2}{R_1+R_2}V_{\mathrm{B}}$$

Applying Thévenin's theorem as before, the current flowing through the meter will be

$$I_m = \frac{\dfrac{V_B - E + \mu E + \mu V_i}{r_a + (\mu + 1)R} R - \dfrac{R_2}{R_1 + R_2} V_B}{R_m + \dfrac{R_1 R_2}{R_1 + R_2} + \dfrac{R r_a/(\mu + 1)}{r_a/(\mu + 1) + R}}$$

where $\dfrac{R \,.\, r_a/(\mu + 1)}{r_a/(\mu + 1) + R}$ is the output impedance of the cathode follower.

On re-arrangement this gives

$$I_m = \frac{\mu V_i R + \dfrac{V_B}{R_1 + R_2}\Big\{R_1 R - R_2\,(r_a + \mu R)\Big\} - E_0 R + \mu E R}{R r_a + \left(R_m + \dfrac{R_1 R_2}{R_1 + R_2}\right)\{r_a + (\mu + 1)R\}} \quad .. \quad .. \quad .. \quad .. \quad (10)$$

The balance condition for no input is

$$\frac{V_B}{R_1 + R_2}\Big\{R R_1 - R_2(r_a + \mu R)\Big\} = R(E_0 - \mu E) \quad .. \quad .. \quad .. \quad (11)$$

Again this condition contains V_B so that the zero is not independent of fluctuations in the h.t. voltage. In the special case when $R R_1 = R_2(r_a + \mu R)$ (i.e., $E_0 = \mu E$) the circuit will be balanced for zero input voltage, and both the zero and the out-of-balance current will be independent of fluctuations in the h.t. voltage. This case requires that

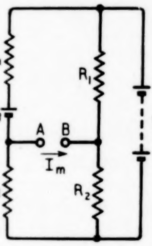


Fig. 5. *Equivalent circuit of Fig. 4.*

$$R = \frac{R_2}{R_1 - \mu R_2} \,.\, r_a \text{ and } E = \frac{E_0}{\mu} \quad .. \quad (12)$$

The sensitivity for the general case is

$$\frac{\partial I_m}{\partial V_i} = \frac{\mu R}{R r_a + \left(R_m + \dfrac{R_1 R_2}{R_1 + R_2}\right)\{r_a + (\mu + 1)R\}} \quad .. \quad .. \quad .. \quad (13)$$

and also when the circuit is balanced for $V_i = 0$; i.e., substituting from (11).

$$\frac{\partial I_m}{\partial V_B} = \frac{R(E_0 - \mu E)/V_B}{R r_a + \left(R_m + \dfrac{R_1 R_2}{R_1 + R_2}\right)\{r_a + (\mu + 1)R\}} \quad .. \quad .. \quad .. \quad (14)$$

so that the stability $\sigma = \left(\dfrac{dV_B}{dV_i}\right)_{I_m \text{ const}} = \dfrac{-\mu V_B}{E_0 - \mu E}$ (15)

When $E_0 = \mu E$ this becomes infinite, as might be expected, and in practice this condition is easily satisfied.

Another case of interest is when the circuit is made self-biasing so that $E = 0$. In this case the balance condition, found by inserting $E = 0$ in equation (11), is not independent of V_B so that compensation against changes in h.t. voltage cannot be obtained. The stability reduces to $\sigma = -\dfrac{\mu V_B}{E_0}$ indicating the need for a high-μ valve.

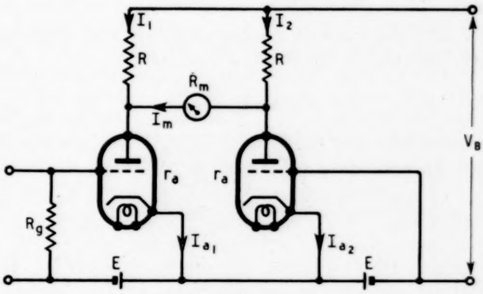


Fig. 6. *Circuit of two-valve amplifier with anode resistors.*

4. Comparison of Types I and II

In general the zero is affected in both cases by fluctuations in the h.t. voltage, although in Case II both the zero and the meter reading can be made independent of h.t. voltage by choosing $E = E_0/\mu$. The stability, defined as above, is better in Case II, but the current amplification is smaller owing to negative feedback. However, this has the advantage that the sensitivity is less dependent on the valve characteristics, so that ageing and valve replacements do not affect the calibration so much. Provided the valve is not operated non-linearly, when the above analysis no longer holds, the sensitivity can be increased in both cases by increasing the size of the load resistor, although this would necessitate a higher h.t. voltage.

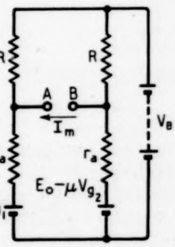


Fig. 7. *Equivalent circuit of Fig. 6.*

5. Type III.—Two Valves; Anode Resistors

Fig. 6 shows a double-valve bridge amplifier in which two identical valves are used and the resistors are placed in the anode circuit. The equivalent circuit of this arrangement is shown in Fig. 7.

The open circuit voltage between A and B is

$$(V_B - E_0 + \mu V_{g2})\frac{R}{R + r_a} - (V_B - E_0 + \mu V_{g1})\frac{R}{R + r_a}$$

$$= \frac{\mu R}{R + r_a}(V_{g2} - V_{g1})$$

$$= \frac{\mu V_i R}{R + r_a}$$

so that the current flowing through the meter is, by Thévenin's theorem, given by

$$I_m = \frac{\mu V_i \dfrac{R}{R + r_a}}{R_m + \dfrac{2Rr_a}{R + r_a}}$$

$$= \frac{\mu R V_i}{2Rr_a + R_m(R + r_a)}$$

Since this equation does not contain V_B the output current is independent of h.t. voltage.

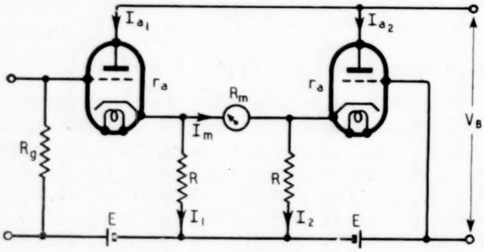


Fig. 8. *Two-valve circuit with cathode resistors.*

Also $I_m = 0$ when $V_i = 0$ so that under ideal conditions the circuit will be automatically balanced. The sensitivity is given by

$$\frac{\partial I_m}{\partial V_i} = \frac{\mu R}{2Rr_a + R_m(R + r_a)} \quad \cdots \quad \cdots \quad (16)$$

and the limit of $\partial I_m/\partial V_i$ for R_m approaching zero is $g_m/2$.

This shows that when R_m is small the most suitable type of valve for this arrangement is one of high slope. The stability σ for this circuit is infinite, since $\partial I_m/\partial V_i = 0$, indicating that fluctuations in the h.t. voltage produce only second-order variations in the output current.

6. Type IV.—Two Valves; Cathode Resistors

Fig. 8 shows a double-valve bridge amplifier employing cathode resistors[2] and two batteries E to bring the grids to a suitable operating point. The equivalent circuit is shown in Fig. 9.

The current flowing through the left-hand valve with AB on open circuit is

$$I_{a1} = \frac{V_B - E_0 + \mu V_{g1}}{R + r_a}$$

where $V_{g1} = V_i - I_{a1}R + E$

which gives

$$I_{a1} = \frac{V_B - E_0 + \mu E + \mu V_i}{r_a + (\mu + 1)R}$$

Similarly $I_{a2} = \dfrac{V_B - E_0 + \mu E}{r_a + (\mu + 1)R}$

Hence the open-circuit voltage between A and B is

$$V_{AB} = \frac{\mu R V_i}{r_a + (\mu + 1)E} \quad \cdots \quad \cdots \quad (17)$$

Applying Thévenin's theorem, the output current

$$I_m = \frac{\dfrac{\mu R V_i}{r_a + (\mu + 1)R}}{R_m + \dfrac{2Rr_a/(\mu + 1)}{r_a/(\mu + 1) + R}}$$

$$\text{or } I_m = \frac{\mu R V_i}{2Rr_a + R_m\{r_a + (\mu + 1)R\}} \quad (18)$$

Again this equation does not contain V_B, so that the output current is independent of h.t. voltage. Also, as before the circuit is automatically balanced when $V_i = 0$.

The sensitivity

$$\frac{\partial I_m}{\partial V_i} = \frac{\mu R}{2Rr_a + R_m\{r_a + (\mu + 1)R\}} \quad \cdots \quad (19)$$

and the limit of $\partial I_m/\partial V_i$ for R_m approaching zero is $g_m/2$ as before.

Equation (19) can be very easily derived if the circuit is replaced by an equivalent constant-current generator $g_m V_i$ working into the circuit of Fig. 10.

As can be seen, the current flowing through the branch R_m when $R_m = 0$ is given by $g_m V_i/2$, and in this case there is no stabilizing action due to negative feedback. On the other hand with R_m large and r_a/R small $\partial I_m/\partial V_i \rightarrow 1/R_m$ showing all the advantages of full negative feedback.

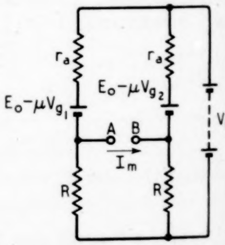


Fig. 9. *Equivalent circuit of Fig. 8.*

7. Comparison of Types III and IV

In both cases fluctuations in h.t. voltage produce second-order effects only. Also from the formulae (16) and (19), it can be seen that the sensitivity is greater with Type III than with Type IV. As with Types I and II, the sensitivity can be increased by increasing the size of the load resistors, and the h.t. voltage, provided the valves are not operated non-linearly, when the analysis is not valid. When the meter resistance is small the sensitivity in both cases tends to $g_m/2$, showing the need for a high-slope valve.

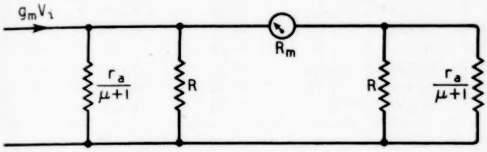


Fig. 10. *Circuit equivalent to Fig. 8 when fed by a constant-current generator.*

8. Non-linear Operation

When the valves are operated non-linearly the response is more easily determined by graphical than analytical methods. The procedure in Cases I and II will be described briefly, but the more important Cases III and IV will be dealt with fully.

Case I

The response of this circuit can readily be determined by plotting on the characteristics of the valve the load line corresponding to the effective anode resistor, which is

$$\frac{R\left(R_m+\dfrac{R_1R_2}{R_1+R_2}\right)}{R+R_m+\dfrac{R_1R_2}{R_1+R_2}}$$

The change in the voltage produced across the effective anode resistor by a given input voltage can then be read from the characteristics, and the output current determined by dividing this voltage by $R_m+\dfrac{R_1R_2}{R_1+R_2}$.

Case II.

The response in this case can be determined in the normal way as for cathode followers. The dynamic characteristic for a resistor

$$\frac{R\{R_m+R_1R_2/(R_1+R_2)\}}{R+R_m+R_1R_2/(R_1+R_2)}$$

is first plotted, and since this effective resistor is in the cathode circuit, the voltage produced across it by various input voltages can be found by plotting on the dynamic characteristic the load lines corresponding to the input voltages. The output current is then given by the voltage produced across the effective cathode resistor divided by $R_m+\dfrac{R_1R_2}{R_1+R_2}$. The effective cathode resistor has a linearizing effect on the response in this type as with the normal cathode follower.

Case III.

When this circuit is operated non-linearly the response curve is best determined by assuming various values for the current flowing through the second valve, which operates up and down the anode characteristic corresponding to the steady biasing voltage on its grid. The anode voltage V_{a2} on this valve can be determined from this characteristic when I_{a2} is known. The voltage drop V_{R2} across the second anode resistor, the current I_2 flowing through it, the meter current I_m, the anode voltage V_{a1} on valve (1), the voltage drop V_{R1} across the first anode resistor, the current I_1 flowing through it, and the anode current I_{a1} flowing in valve (1) can then all be calculated from the following equations :

$$V_{R2} = V_B - V_{a2} \quad \ldots \quad \ldots \quad \ldots \quad (21)$$
$$I_2 = V_{R2}/R_2 \quad \ldots \quad \ldots \quad \ldots \quad (22)$$
$$I_m = I_2 - I_{a2} \quad \ldots \quad \ldots \quad \ldots \quad (23)$$
$$V_{a1} = V_{a2} - R_m I_m \quad \ldots \quad \ldots \quad (24)$$
$$V_{R1} = V_B - V_{a1} \quad \ldots \quad \ldots \quad \ldots \quad (25)$$
$$I_1 = V_{R1}/R_1 \quad \ldots \quad \ldots \quad \ldots \quad (26)$$
$$I_{a1} = I_m + I_1 \quad \ldots \quad \ldots \quad \ldots \quad (27)$$

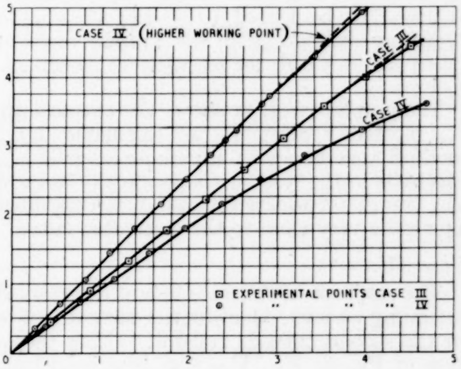


Fig. 11. *Experimental and calculated amplifier characteristics.*

and thus since I_{a1}, V_{a1} are known, V_{g1}, can be read from the valve characteristics and V_i can be calculated from

$$V_i = V_{g1} + E \quad \ldots \quad \ldots \quad \ldots \quad (28)$$

Hence by choosing certain values for I_{a2}, a series of values for I_m and V_i, can be obtained.

Practical Example.

Table I shows the results obtained using the above method for an ECC32 valve. The h.t. voltage was assumed to be 287 volts and the anode resistors 20,000 ohms. The grids were assumed to be biased to -4.85 V, a suitable operating voltage, and the output meter was taken as 0–5 mA meter with a resistance of 5 ohms.

TABLE I

I_{a2} (mA)	V_{a2} (volts)	V_{R2} (volts)	I_2 (mA)	I_m (mA)	V_{a1} (volts)	V_{R1} (volts)	I_1 (mA)	I_{a1} (mA)	V_{g1} (volts)	V_i (volts)
3.45	218.0	69.0	3.45	0	218.0	69.0	3.45	3.45	− 4.85	0
3.25	214.0	73.0	3.65	0.40	214.0	73.0	3.65	4.05	− 4.42	0.43
3.00	210.0	77.0	3.85	0.85	210.0	77.0	3.85	4.70	− 3.98	0.87
2.75	205.0	82.0	4.10	1.35	205.0	82.0	4.10	5.45	− 3.50	1.35
2.50	200.0	87.0	4.35	1.85	200.0	87.0	4.35	6.20	− 3.00	1.85
2.25	196.0	91.0	4.55	2.30	196.0	91.0	4.55	6.85	− 2.60	2.25
2.00	190.0	97.0	4.85	2.85	190.0	97.0	4.85	7.70	− 2.05	2.80
1.75	184.0	103.0	5.15	3.40	184.0	103.0	5.15	8.55	− 1.47	3.38
1.50	178.0	109.0	5.45	3.95	178.0	109.0	5.45	9.40	− 1.00	3.85
1.25	172.0	115.0	5.75	4.50	172.0	115.0	5.75	10.25	− 0.40	4.45

TABLE II

I_2 (mA)	V_{g2} (volts)	V_{a2} (volts)	I_{a2} (mA)	I_m (mA)	I_1 (mA)	I_{a1} (mA)	V_{a1} (volts)	V_{g1} (volts)	V_i (volts)
3.45	− 4.85	218.0	3.45	0	3.45	3.45	218.0	− 4.85	0
3.47	− 5.25	217.6	2.74	0.73	3.47	4.20	217.6	− 4.44	0.81
3.49	− 5.65	217.2	2.11	1.38	3.49	4.87	217.2	− 4.13	1.52
3.51	− 6.05	216.8	1.58	1.93	3.51	5.44	216.8	− 3.84	2.21
3.53	− 6.45	216.4	1.05	2.48	3.53	6.01	216.4	− 3.60	2.85
3.55	− 6.85	216.0	0.65	2.90	3.55	6.45	216.0	− 3.40	3.45
3.57	− 7.25	215.6	0.35	3.22	3.57	6.79	215.6	− 3.24	4.01
3.59	− 7.65	215.2	0.05	3.54	3.59	7.13	215.2	− 3.08	4.57

The graph of Fig. 11 shows the output current I_m plotted against V_i as calculated by this method together with experimental points. As can be seen the response is practically linear over the range considered, and the experimental points lie very close to the calculated curve.

Case IV.

The response in this case is best determined by assuming various values for the current I_2 flowing in the second cathode resistor. Using the notation of Fig. 8, V_{a2}, V_{g2}, can now be calculated from the equations

$$V_{a2} = V_B - RI_2 \quad .. \quad .. \quad .. \quad (29)$$

$$V_{g2} = E - RI_2 \quad .. \quad .. \quad .. \quad (30)$$

Now since V_{a2} and V_{g2} are known I_{a2} can be read off from the valve characteristics. I_m, I_1, I_{a1}, and V_{a1} can then be calculated from the following equations

$$I_m = I_2 - I_{a2} \quad .. \quad .. \quad .. \quad (31)$$

$$I_1R_1 = I_2R_2 + I_mR_m \quad .. \quad .. \quad (32)$$

$$I_{a1} = I_1 + I_m \quad .. \quad .. \quad .. \quad .. \quad (33)$$

$$V_{a1} = V_B - RI_1 \quad .. \quad .. \quad .. \quad (34)$$

and since V_{a1}, I_{a1} are known, V_{g1} can be read from the valve characteristics. V_i can then be determined from

$$V_i = V_{g1} + RI_1 - E \quad .. \quad .. \quad .. \quad (35)$$

Thus by choosing certain values for I_{a2}, a series of values for I_m and V_i can be obtained.

Practical Example.

Table II shows the results obtained using the above method for an ECC32 valve. The same working point, load resistors and output meter have been assumed as before.

The lower graph in Fig. 11 shows the calculated output current I_m plotted against V_i, together with experimental points, and as can be seen the response is far from linear. This is because the second valve is driven nearly into cut-off, while the first valve is driven towards $V_{g1} = 0$ by an amount which is roughly half the input voltage. Thus compared with the previous case, the working range for linear response is reduced, and a better working point would be in the region of -2.50 V. An experimental sensitivity curve which was obtained using the latter working point is also shown by the upper graph in Fig. 11. The departure from linearity is approximately the same as in Case III which is never greater than 1% of full-scale deflection up to inputs of 3 volts, while within the range 3-4 volts Case III is slightly more linear.

Thus the arrangement employing anode resistors is equivalent, as far as linearity is concerned, to that employing cathode resistors with due consideration to the optimum working point.

9. Choice of Output Meter

So far, the expression $\partial I_m/\partial V_i$ has been taken as the criterion of sensitivity, but this is not necessarily the only one. Since the final indication is an angular deflection, perhaps a better criterion would be the Deflection Sensitivity defined by

$$\text{Deflection sensitivity} = \frac{\text{Angular deflection}}{\text{Input voltage}}$$

or

$$S = \phi \partial I_m/\partial V_i \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (36)$$

where ϕ = meter sensitivity in degrees deflection per μA. Approximately

$$\phi = k\sqrt{R_m} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (37)$$

so that

$$S = k\sqrt{R_m} \, . \, \partial I_m/\partial V_i \quad \ldots \quad \ldots \quad (38)$$

Differentiation of this expression with respect to R_m shows that S is a maximum when

$$2R_m \cdot \frac{\partial}{\partial R_m}\left\{\frac{\partial I_m}{\partial V_i}\right\} + \frac{\partial I_m}{\partial V_i} = 0 \quad \ldots \quad (39)$$

Applying this equation to all four cases it is easy to find the optimum meter resistance R°_m. It will be found that in

Case I

$$R^\circ_m = \frac{Rr_a}{R + r_a} + \frac{R_1R_2}{R_1 + R_2} \quad \ldots \quad \ldots \quad (40)$$

Case II

$$R^\circ_m = \frac{Rr_a/(\mu + 1)}{R + \dfrac{r_a}{\mu + 1}} + \frac{R_1R_2}{R_1 + R_2} \quad \ldots \quad (41)$$

Case III

$$R^\circ_m = \frac{2Rr_a}{R + r_a} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (42)$$

Case IV

$$R^\circ_m = \frac{2Rr_a/(\mu + 1)}{R + r_a/(\mu + 1)} \quad \ldots \quad \ldots \quad \ldots \quad (43)$$

Thus in all four cases, optimum performance is obtained when the meter resistance is equal to the output impedance of the circuit; i.e., when maximum power is delivered. In actual practice this condition is only easy to satisfy in Case IV where the optimum value R°_m is comparatively low.

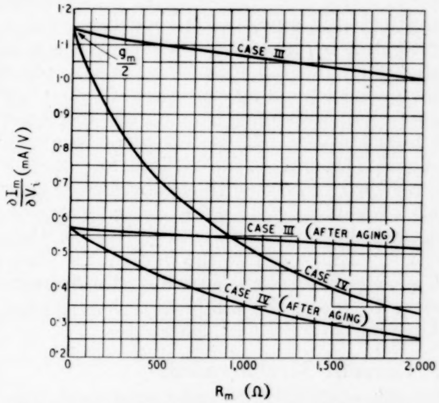


Fig. 12. *Effect of meter resistance on sensitivity.*

To find how exactly the choice of R_m affects the sensitivity $\partial I_m/\partial V_i$ and the deflection sensitivity S in Cases III and IV, a calculation was made for the ECC32, assuming that

$\mu = 32$
$g_m = 2.3$ mA/V.
$r_a = 14{,}000\ \Omega$.

It was also assumed that $R = r_a$ in both cases. The results are tabulated below.

Case III.

R_m	20	50	100	200	500	1000	2000
$\partial I_m/\partial V_i$	1.14	1.14	1.13	1.13	1.10	1.07	1.00
S/k	5.1	8.1	11.3	15.9	24.6	33.7	44.8

Case IV.

R_m	20	50	100	200	500	824	1000	2000
$\partial I_m/\partial V_i$ ..	1.12	1.08	1.02	0.92	0.71	0.58	0.52	0.33
S/k	5.0	7.6	10.2	13.0	15.9	16.45	16.4	14.9

The graph of Fig. 12 shows the sensitivity $\partial I_m/\partial V_i$ plotted against R_m for the two cases. In each case $\partial I_m/\partial V_i \rightarrow g_m/2$ as $R_m \rightarrow 0$. The graph illustrates well the superiority of Type III where sensitivity is concerned.

Fig. 13 shows the deflection sensitivity plotted against R_m for Cases III and IV, and Case IV shows very well that there is an optimum value for the meter resistance. The optimum value for Case III is 14,000 ohms, clearly not a practical value.

The calculations just given were repeated for $R = 2r_a$ and $R = 3r_a$, and in both cases it was found that the alterations in the response curves were negligible over the range of R_m considered. The effect of aging of the valves was also investigated by assuming a drop in the mutual conductance from 2.30 to 1.15 mA/V together with a corresponding increase in the anode characteristic resistance from 14,000 to 28,000 Ω. The sensitivity v. R_m curves were recalculated for Cases III and IV and these are plotted in Fig. 12. As can be seen the calibration in Case IV approaches its original value as the value of R_m is increased to a much greater extent than in Case III. This is due to the fact that in Case IV, as R_m is increased the negative feedback increases tending to make the calibration less dependent on the characteristics of the valves.

10. Current Measurement

All the circuits previously described may be used for the measurement of current. The current is passed through the grid resistor of the input valve and a voltage is produced which gives a deflection as before. The current amplification obtainable can be derived in each case by multiplying the sensitivity by the value R_g of the grid resistor;

$$\text{i.e.,}\ \frac{\partial I_m}{\partial I_i} = R_g \frac{\partial I_m}{\partial V_i} \qquad \ldots \qquad \ldots \qquad \ldots \quad (44)$$

Thus the larger the grid resistor, the larger the current amplification. There are, however, limitations to the size of the grid resistor due to the flow of grid current.[3]

11. Conclusions

The analysis shows that with the single-valve type of voltmeter independence of h.t. voltage variations cannot be obtained, except when the load resistor is placed in the cathode circuit of the valve together with a positive biasing battery of value $E = \mu E_0$. In the case of the two valve type of voltmeter independence of h.t. voltage variation is obtained only if the two valves are identical.

The statement[2] that the linearity of the double-valve circuit is increased by the use of cathode resistors in place of anode resistors is shown to be at variance with our findings.

Thus while it appears that in the single-valve circuit the placing of R in the cathode lead has some advantage, this does not appear to be the case in the two-valve circuit.

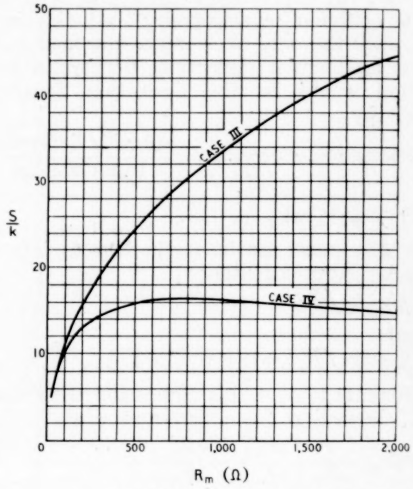


Fig. 13. *Effect of meter resistance on deflection sensitivity.*

If the deflection sensitivity is taken as the criterion of performance then optimum results are obtained when the meter resistance is equal to the output resistance of the circuit used. This condition cannot be realized in practice in the double-valve circuit with anode resistors.

Finally if a 0-100 μA meter is used with an ECC32 valve in the recommended arrangement an input voltage of approximately 4 mV will produce an output current of 5 μA.

12. Acknowledgment

The authors wish to thank J. A. M. van Moll and the Directors of Philips Electrical Ltd., for permission to publish this work.

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MUTUAL IMPEDANCE OF TWO CENTRE-DRIVEN PARALLEL AERIALS

By B. Starnecki and E. Fitch

(Signals Research and Development Establishment, Ministry of Supply)

SUMMARY.—A formula and curves are given for the mutual impedance between two symmetrically-placed parallel aerials assuming a sinusoidal distribution of aerial current. The values are shown to be in fair agreement with measurements.

1. Introduction

It is known that a system of two aerials may be represented by the equivalent network shown in Fig. 1. In this figure Z_{11} and Z_{22} are the self-impedances of the two aerials, measured at the terminals; Z_{12} is the mutual impedance between them; generators with e.m.f.s E_g and E_l with internal impedances Z_g and Z_l are applied at the terminals of the respective aerials. If the loop-currents (the currents at the terminals) are I_1 and I_2, the network equations are:

$$\begin{aligned} Z_{11} I_1 + Z_{12} I_2 &= E_g - Z_g I_1 \\ Z_{12} I_1 + Z_{22} I_2 &= E_l - Z_l I_2 \end{aligned}$$

The currents at the aerial terminals may be evaluated from these equations provided that all the impedances are known.

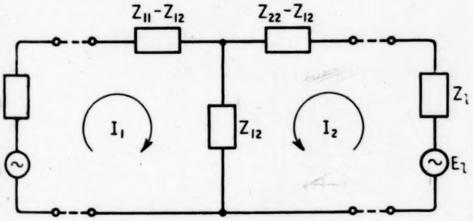


Fig. 1. *Equivalent circuit of two aerials.*

It is important to note that Z_{11} and Z_{22} are the self-impedances of the aerials which differ, in general, from the 'intrinsic' impedances. The intrinsic impedance is the input impedance of a single aerial in free space; its value for symmetrically driven aerials may be calculated from existing formulae[1, 2, 3]. The self-impedance is the input impedance of the aerial in the presence of the other aerial with open-circuited terminals; this has not yet been evaluated, but for practical use the difference between the intrinsic and self-impedance can usually be neglected provided that the spacing of the aerials is not too small*.

Values of the mutual impedance Z_{12} of two parallel aerials of equal length have been calculated (Ref. 1, page 372).

A general formula for two infinitely thin aerials has been derived by J. Aharoni at S.R.D.E., and a description of his method can be found in his book[4]. From this theory, assuming that the distribution of aerial current is sinusoidal, J. H. Tait at S.R.D.E. has derived practical formulae† for two symmetrically-driven parallel aerials, not necessarily of equal length, with terminals lying on a line perpendicular to the aerials; this paper records the results obtained.

2. Computation of Mutual Impedance

The formulae obtained by Tait are

$$\begin{aligned} R_{12}\frac{\sin kl_1 \sin kl_2}{30} = {} \\ \cos k(l_1+l_2)[2\,\mathrm{Ci}\,p - \mathrm{Ci}\,s - \mathrm{Ci}\,t + \mathrm{Ci}\,u \\ - \mathrm{Ci}\,q + \mathrm{Ci}\,v - \mathrm{Ci}\,r] \\ + \sin k(l_1+l_2)[-\mathrm{Si}\,s + \mathrm{Si}\,t + \mathrm{Si}\,u - \mathrm{Si}\,q \\ - \mathrm{Si}\,v + \mathrm{Si}\,r] \\ + \cos k(l_1-l_2)[2\,\mathrm{Ci}\,p - \mathrm{Ci}\,s - \mathrm{Ci}\,t + \mathrm{Ci}\,x \\ - \mathrm{Ci}\,r + \mathrm{Ci}\,w - \mathrm{Ci}\,q] \\ + \sin k(l_1-l_2)[\mathrm{Si}\,s - \mathrm{Si}\,t - \mathrm{Si}\,x + \mathrm{Si}\,r \\ + \mathrm{Si}\,w - \mathrm{Si}\,q] \end{aligned}$$

$$\begin{aligned} X_{12}\frac{\sin kl_1 \sin kl_2}{30} = {} \\ \cos k(l_1+l_2)[-2\mathrm{Si}\,p + \mathrm{Si}\,s + \mathrm{Si}\,t - \mathrm{Si}\,u \\ + \mathrm{Si}\,q - \mathrm{Si}\,v + \mathrm{Si}\,r] \\ + \sin k(l_1+l_2)[-\mathrm{Ci}\,s + \mathrm{Ci}\,t + \mathrm{Ci}\,u - \mathrm{Ci}\,q \\ - \mathrm{Ci}\,v + \mathrm{Ci}\,r] \\ + \cos k(l_1-l_2)[-2\mathrm{Si}\,p + \mathrm{Si}\,s + \mathrm{Si}\,t - \mathrm{Si}\,x \\ + \mathrm{Si}\,r - \mathrm{Si}\,w + \mathrm{Si}\,q] \\ + \sin k(l_1-l_2)[\mathrm{Ci}\,s - \mathrm{Ci}\,t - \mathrm{Ci}\,x + \mathrm{Ci}\,r \\ + \mathrm{Ci}\,w - \mathrm{Ci}\,q] \end{aligned}$$

---

* It should be noted that sometimes the effect of the other aerial cannot be neglected. For example, suppose that the first aerial is a half-wavelength dipole and the second a full-wavelength dipole. Then when the latter is open-circuited the influence of the half-wavelength wires on the first aerial may be great.

† Two papers have recently appeared giving the same formula as that quoted here, namely, C. Russel Cox, "Mutual Impedance between Vertical Antennas of Unequal Heights", *Proc. Inst. Radio Engrs*, November 1947, Vol. 35, No, 11, p. 1367, and Giorgio Barzilai, Mutual Impedance of Parallel Aerials", *Wireless Engineer*, November 1948, Vol. 25, No. 302, p. 343.

$$\begin{aligned}
\text{where } kd &= p\\
k[\sqrt{l_1^2 + d^2} + l_1] &= q\\
k[\sqrt{l_1^2 + d^2} - l_1] &= r\\
k[\sqrt{l_2^2 + d^2} + l_2] &= s\\
k[\sqrt{l_2^2 + d^2} - l_2] &= t\\
k[\sqrt{(l_1 + l_2)^2 + d^2} + (l_1 + l_2)] &= n\\
k[\sqrt{(l_1 + l_2)^2 + d^2} - (l_1 + l_2)] &= v\\
k[\sqrt{(l_1 - l_2)^2 + d^2} + (l_1 - l_2)] &= w\\
k[\sqrt{(l_1 - l_2)^2 + d^2} - (l_1 - l_2)] &= x
\end{aligned}$$

and

$$\begin{aligned}
Z_{12} &= R_{12} + jX_{12}\\
k &= 2\pi/\lambda\\
\lambda &= \text{wavelength}
\end{aligned}$$

and the significance of l_1, l_2 and d can be seen from Fig. 2.

The formulae are too complicated for immediate practical use, especially since small differences of large quantities may appear in computation. Consequently the results have been computed and are shown in the form of curves for a wide range of parameters in Figs. 3 to 7. The computation was done partly by the Scientific Computing Service and partly at S.R.D.E.

In order to facilitate interpolation, the curves represent the mutual impedance in the form

$$\begin{aligned}
Z_{12} &= |Z_{12}|e^{j\theta}\\
\text{where } |Z_{12}| &= \sqrt{R_{12}^2 + X_{12}^2}\\
\theta &= \tan^{-1}\frac{X_{12}}{R_{12}}
\end{aligned}$$

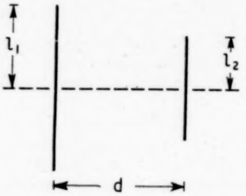


Fig. 2. *Two parallel aerials.*

The figures lettered (a) show $|Z_{12}|$ and those lettered *(b)* show θ.

The curves have been normalized, using the parameters

$$\begin{aligned}
\alpha &= 2\pi l_1/\lambda\\
\beta &= 2\pi d/\lambda\\
\phi^\circ &= 90^\circ - 360\frac{d}{\lambda} - \theta^\circ
\end{aligned}$$

Each set of curves is for one value of l_1/l_2 (= 1, 1.5, 2, 3, 4). Curves are plotted for $l_1/\lambda = 0.016$ to 0.45 and $d/\lambda = 0.032$ to 1.6

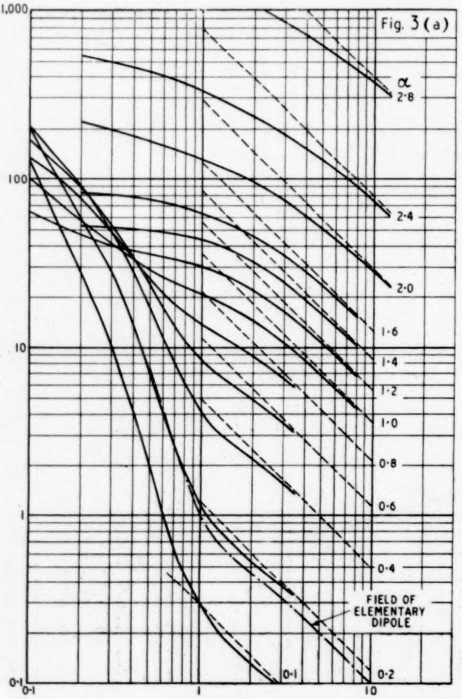
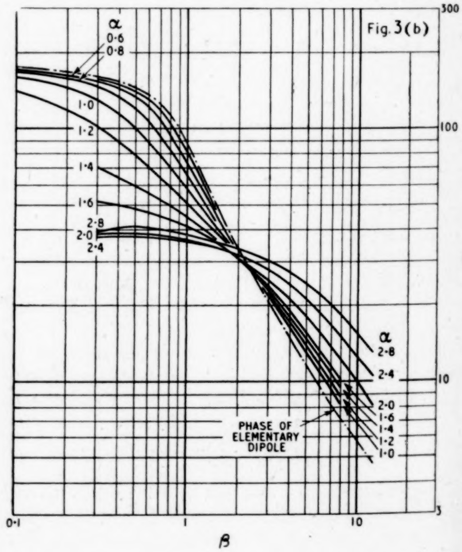
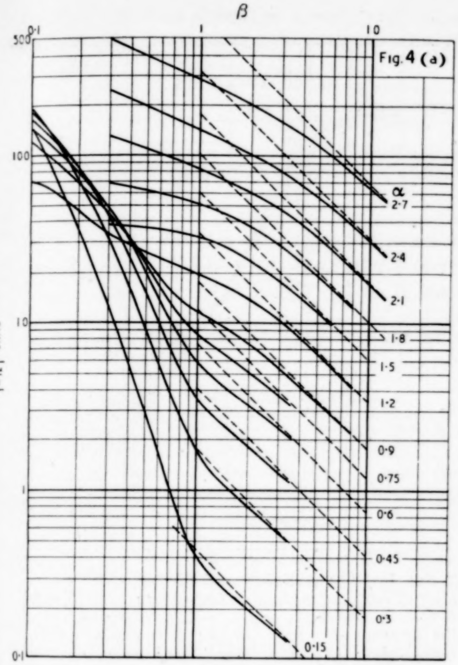


Fig. 3. (*a*) *The modulus and* (*b*) *the phase* $\theta_{12} = \tan^{-1}X_{12}/R_{12}$ *of the mutual impedance of two parallel dipoles of equal length l as a function of the spacing d.* $\alpha = 2\pi l/\lambda$, $\beta = 2\pi d/\lambda$, $\phi^\circ = 90^\circ - 360\,d/\lambda - \theta^\circ$. *The dotted lines represent an asymptotic approximation; the chain line represents the phase of the field strength of an elementary dipole at a distance d from it.* (*The scale is arbitrary*).





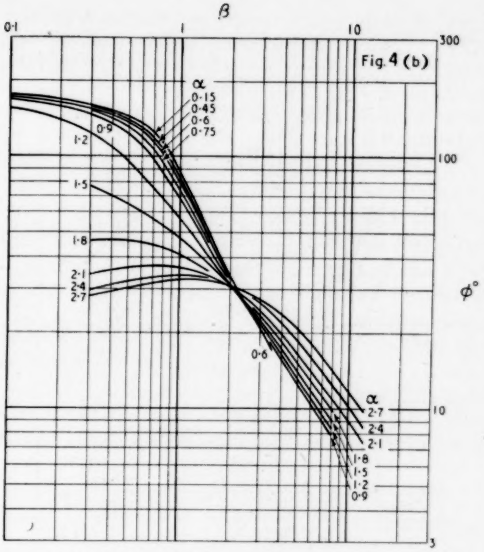
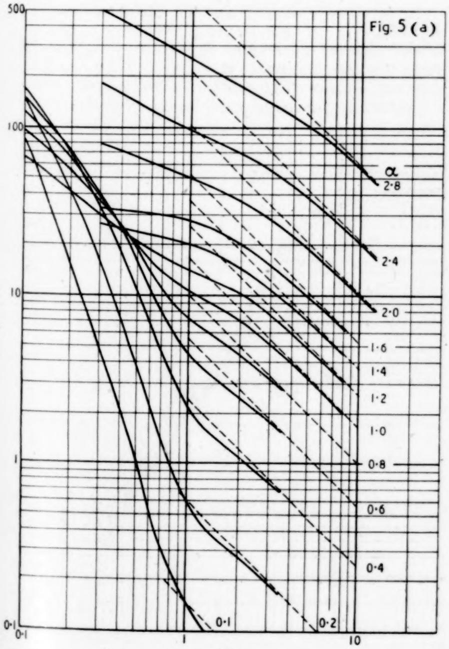
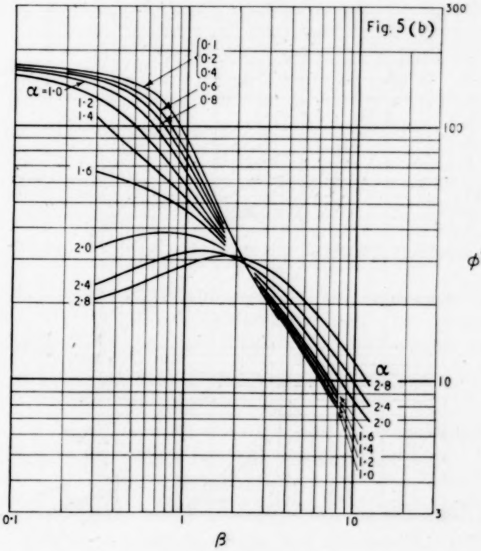
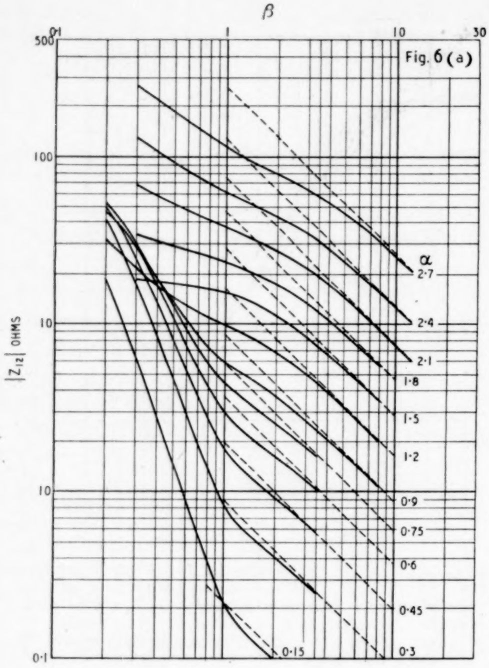


Fig. 4. (*a*) *The modulus and* (*b*) *the phase* $\theta_{12} = \tan^{-1} X_{12}/R_{12}$ *of the mutual impedance of two parallel dipoles of lengths* l_1 *and* $l_2 = l_1/1.5$ *as a function of the spacing* d. $\alpha = 2\pi l_1/\lambda$; $\beta = 2\pi d/\lambda$; $\phi^\circ = 90^\circ - 360\, d/\lambda - \theta^\circ$. *The dotted lines represent an asymptotic approximation.*

Fig. 5. (*a*) *The modulus and* (*b*) *the phase* $\theta_{12} = \tan^{-1} X_{12}/R_{12}$ *of the mutual impedance of two parallel dipoles of lengths* l_1 *and* $l_2 = l_1/2$ *as a function of the spacing* d. $\alpha = 2\pi l_1/\lambda$; $\beta = 2\pi d/\lambda$; $\phi^\circ = 90^\circ - 360\, d/\lambda - \theta^\circ$. *The dotted lines represent an asymptotic approximation.*







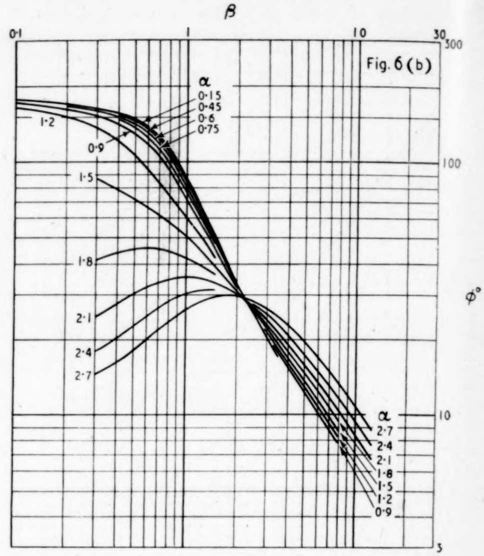
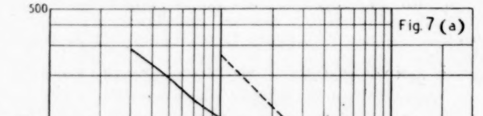
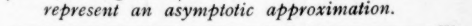


Fig. 6. (*a*) *The modulus and* (*b*) *the phase* $\theta_{12} = \tan^{-1} X_{12}/R_{12}$ *of the mutual impedance of two parallel dipoles of lengths* l_1 *and* $l_2 = l_1/3$ *as a function of the spacing* d. $\alpha = 2\pi l_1/\lambda$; $\beta = 2\pi d/\lambda$; $\phi° = 90° - 360\ d/\lambda - \theta°$. *The dotted lines represent an asymptotic approximation.*

Fig. 7. (*a*) *The modulus and* (*b*) *the phase* $\theta_{12} = \tan^{-1} X_{12}/R_{12}$ *of the mutual impedance of two parallel dipoles of lengths* l_1 *and* $l_2 = l_1/4$ *as a function of the spacing* d. $\alpha = 2\pi l_1/\lambda$; $\beta = 2\pi d/\lambda$; $\phi° = 90° - 360\ d/\lambda - \theta°$. *The dotted lines represent an asymptotic approximation.*





The broken lines show the asymptotic value of $|Z_{12}|$ for wide spacing d,

$$|Z_{12}| = \frac{120}{kd} \tan \frac{kl_1}{2} \tan \frac{kl_2}{2}$$

$$\theta^\circ = 90^\circ - 360\, d/\lambda$$

A feature of the curves is the rapid increase in mutual impedance for small separations and short aerials. This may be ascribed to the increasing influence of the induction field. For purposes of comparison the field in the plane of symmetry of an elementary dipole has been plotted in Fig. 3 (chain line) with arbitrary scale. It may be seen that the behaviour of the field strength of such a dipole is quite similar to that of the mutual impedance.

3. Comparison with Experiment

The values obtained from the curves given above have been checked experimentally. An extensive series of measurements has been made by N. P. Quinlivan at S.R.D.E. using vertical aerials mounted above a horizontal earth mat ('G.L. mat') of 400-ft average diameter. The frequency range was 3 to 20 Mc/s. The accuracy of the measuring equipment was estimated to be of the order of 10 per cent.

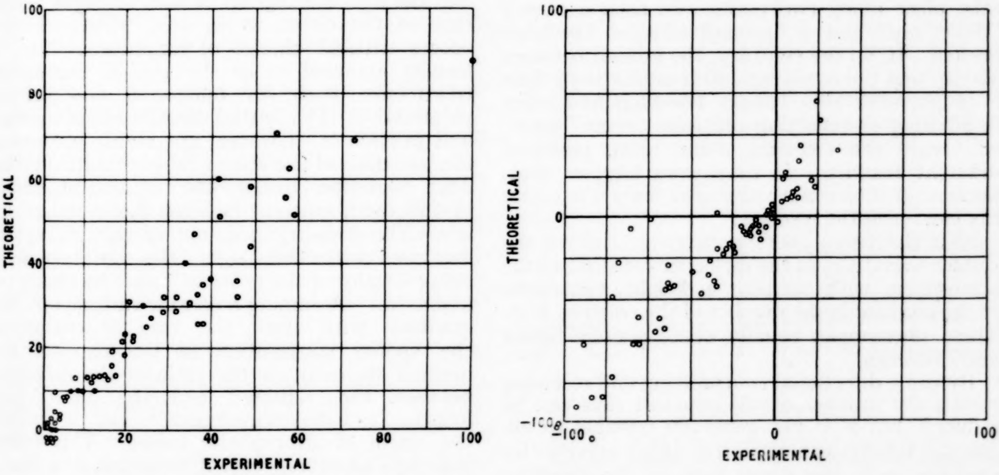


Fig. 8. *Comparison between theoretical and experimental results; (a) mutual resistance; (b) mutual reactance.*

The number of experimental points was usually insufficient to plot complete curves corresponding to the theoretical curves given in Figs. 3 to 7, but an overall comparison between the theoretical and experimental values of resistance and reactance is given in Fig. 8. The theoretical value is plotted against each experimental value obtained. It can be seen that though there is a considerable scatter, especially for high values of impedance, the general trend seems satisfactory. (The product-moment correlation coefficient calculated for the points was found to be 0.94). It should be noted that the experimental results were obtained for aerials which were, of course, not infinitely thin.

The method of measurement was as follows :—

(a) The second aerial was removed and the input impedance Z_{11} of the first aerial measured.

(b) The first aerial was removed and the input impedance Z_{22} of the second aerial measured.

(c) The input impedance Z_i of the first aerial was measured with both aerials in position and the second aerial short-circuited.

(d) Assuming that the impedances measured in (a) and (b) are self-impedances (whereas they are in fact intrinsic impedances) the mutual impedance was calculated from

$$Z_{12} = [Z_{22}\,(Z_{11} - Z_i)]^{\frac{1}{2}}$$

The assumption in (d) may have introduced some errors; unfortunately, it was not possible to measure the self-impedances of the aerials owing to the practical difficulty of open-circuiting the aerials completely.

4. Acknowledgment

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DIVERSITY RECEPTION IN U.S.W. RADIO LINKS

By Giorgio Barzilai, M.Sc. and Gaetano Latmiral

SUMMARY.—Some of the principal troubles, due to multipath transmission in ultra-short-wave radio links, are briefly reviewed, and it is shown how they can be avoided or reduced, when receiving at points of reinforcement.

Because the spatial distribution of interference maxima and minima is not stable, due to variation of the refractive index of the atmosphere, the use of several receiving aerials, suitably displaced, is considered. Criteria for the disposition of the receiving aerials, and for their connection to the receiver, are deduced. Finally these considerations are applied to a practical case.

1. Introduction

IN ultra-short-wave radio links, the signals reaching the receiving aerial usually arrive by two or more paths. If the ground between and around the receiving and transmitting points is flat, and the receiving point is above the line of sight of the transmitter, the propagation will take place along two paths. In such a case a 'direct-ray' and a 'ground-reflected ray' are present. If, on the contrary, the ground between and around the receiving and transmitting points is rough, with hills, towers, buildings and other reradiating or reflecting obstacles, many 'rays' will reach the receiving aerial along paths of different lengths. It may even happen that, because of intervening obstacles, only the direct ray can reach the receiver.

Also the tropospheric reflections, due to the sudden variations of the dielectric constant of the atmosphere with increase in height, contribute to the increase in the number of the received rays. These phenomena usually cause serious fading and distortion.

By using directional transmitting and receiving aerials the number of the received rays can be reduced, but it is not generally possible to eliminate totally the parasitic rays, leaving for example only the direct ray, as the resulting directivities would be so sharp as to make the radio link unstable, principally because of the variation of the atmospheric refractive index.

The simplest way of overcoming or reducing these difficulties, is to use a system of several suitably spaced receiving aerials. Such a system is effective with any type of modulation.

If directional aerials are used, and the propagation takes place over relatively flat ground, the direct ray and the ground-reflected ray are very strong, compared with the parasitic rays arising from tropospheric, or other reflections.

When a simple carrier, or a carrier modulated within a narrow frequency band is transmitted, interference occurs between the direct ray and the ground-reflected ray, so that in moving vertically, regions of reinforcement (field a maximum) and of cancellation (field a minimum) are encountered in turn. The minima are zeros, and the maxima regions of field strength double that of the direct wave, only when reflection occurs without change of amplitude. This is usually assumed to be the case in elementary treatments, both for horizontal and vertical polarization. The spatial distribution of maxima and minima is, however, not stable because of the variation of the atmospheric refractive index. This variation causes the equivalent radius of the earth to vary between 8,000 and 11,000 km. The dielectric constant of the atmosphere decreases with the height, the variation $d\epsilon/dh$ being usually of the order of 1 part in 10,000 per kilometre. Assuming a certain variation of this gradient with time the rate of change of the spatial distribution of the maxima and minima depends on the ratio of the difference between the reflected and the direct path lengths to the wavelength. This is usually the origin of atmospheric fading. This fading generally has a long period, from several minutes to a few hours, because the variation of the average gradient $d\epsilon/dh$ is very slow.

Fading similar to the atmospheric fading, but due to tropospheric reflections, is particularly great when the receiving point is below the line of sight of the transmitter. The magnitude of this fading may reach 40db, and its frequency several cycles per second.[1]

If instead of a single frequency, or a very narrow band of frequencies, a wide frequency band is transmitted, as in the case of television, it is possible to have the phenomenon of frequency distortion, simultaneously with and independently of the fading effect.

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Referring to Fig. 1, suppose A to be the transmitting and B the receiving aerials, and let $\delta = AO + OB - AB$ be the difference between the ground-reflected and the direct-path lengths, and assume that -1 is the reflection coefficient of the ground. In this case it is easy to obtain an expression for the modulus E of the resulting field, corresponding to any one frequency in the band:

$$E = 2E_0|\cos\phi/2| \qquad \text{.. .. ..} \quad (1)$$

where: $\phi = \pi + \frac{2\pi}{\lambda}\delta$

λ is the corresponding wavelength,

E_0 is the field that would be produced at B if the ground-reflected ray were not present.

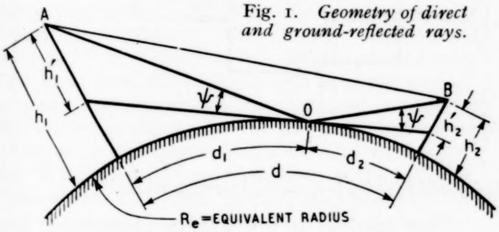

Fig. 1. *Geometry of direct and ground-reflected rays.*

Equation (1) supposes that the modulus of the ground-reflected ray at B is equal to E_0; i.e., it neglects the variation in the modulus due to the variation in the distance. It also assumes that the divergence coefficient, which takes into account the divergence of reflected wave after reflection at the spherically curved surface of the earth, is equal to unity.

Equation (1) shows that the response curve of the system has maxima and minima when λ is varied.

For $\delta = K\lambda/2$ with K odd .. (2)

the field is maximum and equal to $2E_0$,

and for $\delta = (K \pm 1)\lambda/2$ with K odd .. (3)

the field is zero.

If (2) is satisfied for the wavelength λ, then the condition that (3) is satisfied at the same time, for another wavelength λ', is:

$$\left|\frac{\lambda' - \lambda}{\lambda}\right| = \frac{1}{K \pm 1} \qquad \text{.. .. ..} \quad (4)$$

Usually δ, and the bandwidth, do not attain values which satisfy (4). In fact, in normal radio links, K does not exceed 30–40 and the wavelength shifting, due to the modulation, is not greater than several parts per thousand, and therefore much less than $1/(K \pm 1)$, as required to satisfy (4). This means that when the frequency varies, only a small part of the curve representing equation (1) is concerned. Therefore, if δ is so chosen that $dE/d\lambda = 0$, the system will be in condition of minimum distortion. Differentiating (1) with respect to λ it is found that the frequency distortion is a minimum when $\delta = K\lambda/2$ (where K is an odd number and λ is the carrier wavelength); i.e., in zones of maximum field.

When wideband modulation is due to multi-channel transmission, each channel being modulated with a narrow band of frequencies, there will not be any frequency distortion, but the reception level will be different in each channel. This trouble is also reduced when operating in regions of maximum field.

It is also advantageous to receive in regions of maximum field when frequency-modulated or pulse-modulated carriers are used. In the case of a frequency-modulated carrier, the interference of the two principal rays often produces intolerable distortion. If r is the strength ratio of the two interfering rays, this distortion is a minimum when the phase shift α between the two unmodulated carriers satisfies the relation[2]: $\alpha = \cos^{-1}r$. In the worst case, from the point of view of distortion (i.e., when $r = 1$), the distortion is a minimum if $\delta = K\lambda/2$. Moreover, with reception at points of maximum field, the minimum detectable signal in the receiver can be increased; consequently, only the principal signal is received, the parasitic signals, which are usually much weaker, being eliminated.

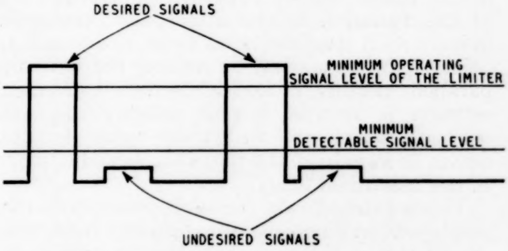
DESIRED SIGNALS
MINIMUM OPERATING SIGNAL LEVEL OF THE LIMITER
MINIMUM DETECTABLE SIGNAL LEVEL
UNDESIRED SIGNALS

Fig. 2. *With pulse modulation interference from delayed signals can be eliminated by increasing the receiver threshold level.*

In the case of time-allocation multi-channel transmission, if the propagation is along paths of very different lengths, pulses relative to a certain channel can interfere with other channels, causing cross-talk and cross-modulation.[3] It can be appreciated that the delays required to produce these effects are of the order of magnitude of several microseconds, and therefore the corresponding differences in path lengths are several hundred metres. The path difference of the two principal rays does not usually reach such a value, so that the phenomena of cross-talk and cross-modulation will always be due to the parasitic signals mentioned above. By working at points of maximum field, it is possible, in this case also, to eliminate the undesired signals, by increasing the minimum detectable signal of the receiver as shown in Fig. 2.

simultaneously. In this way, by suitably proportioning the a.g.c. voltages, and by using special devices when receivers with limiters are employed,[5] it can be ensured that only the systems corresponding to a field above a certain level are utilized.

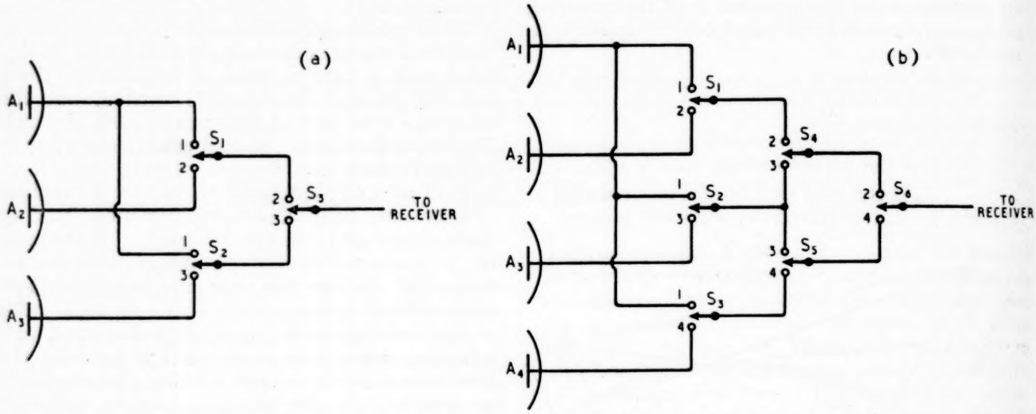

Fig. 3. *Methods of connecting three aerials (a) and four (b) to a receiver through relays.*

2. Diversity Reception

From the considerations given in the preceding paragraph it is evidently of advantage to receive in those regions of space in which the interference of the two principal rays produces the maximum field. These regions, however, are moving, due to the variation of the atmospheric refractive index. As it does not seem to be practicable to 'chase' these maxima, by moving the receiving parabolic mirrors, or horns, the most convenient solution is to use several suitably displaced receiving aerials and to arrange some electrical device to switch on the particular aerial situated in the maximum field.

This is substantially the same principle as that employed in ionospheric diversity reception, except that in this case the receiving systems are distributed in a horizontal plane, while in the atmospheric diversity reception they would be essentially distributed in the vertical direction.[4] In practice, it suffices to distribute the aerials vertically, either by using suitable towers or by taking advantage of the natural slope of the ground. On occasion it is convenient, in order to avoid fading due to lateral reflections, to displace them laterally, rather than to place them in the same vertical line.

The various aerials could each be connected to a receiver, and the output of each receiver used to generate a negative a.g.c. voltage. This voltage must be proportional to the maximum input, and must be applied to all receivers

This method is not always convenient, however, because in the case of multichannel transmission it is necessary to detect and combine each channel separately, and this causes serious complications in the terminal or repeater equipment. In addition, the simultaneous working of two or more receiving systems may increase the distortion, since, as already explained, the weaker signals are usually the more distorted.

It is more convenient, therefore, to use mechanical or electronic relays capable of switching on the system situated in the maximum field.[5] These relays could be driven by auxiliary receivers designed to receive the complex wave, and they must be regulated in such a way that they only operate for a reasonable difference between the signals, in order to avoid instability.

In Fig. 3 (a) and (b) are sketched two possible ways of connecting the relays when three or four aerials are used. In (a), S_1, S_2, S_3 represent three differential relays. Relay S_1 will switch into position 1 or 2 according to whether the signal received by the aerial A_1 is greater or less than the signal received by the aerial A_2. Relay S_2 will switch into position 1 or 3 according to whether the signal received by A_1 is greater or less than the signal received by A_3. And similarly for relay S_3. From the diagram it can be seen that only the aerial receiving the strongest signal will be connected to the receiver. The diagram of Fig. 3 (b) is similar except that it refers to four aerials, and consequently needs two more relays. The case of two aerials is obvious.

In order to establish the proper positions of the receiving aerials, consider a radio link in which the receiving aerial is above the line of sight of the transmitter, take into account only the two principal rays, and refer to Fig. 1.

When the atmospheric refractive index varies, the equivalent earth's radius varies according to the relation:

$$R_e = \frac{1}{1 + (d\epsilon/dh)R_g/2} R_g$$

where R_g is the earth's geometrical radius = 6370 km, and $d\epsilon/dh$ usually varies[6] from -0.63×10^{-4} to -1.36×10^{-4}. Consequently the projections h_1' and h_2', above the plane tangential to the surface of the earth at the reflection point, change and accordingly vary the path difference δ and the field at B. Using well-known methods[7, 8] it is possible to calculate δ in terms of the increment Δh_2 of the height h_2 of the receiving point, for each equivalent radius of the earth. Then curves of the field at B, for each equivalent radius, may be plotted against the increment Δh_2. It will thus be easy to determine the number of the aerials and their vertical displacement, in order to ensure that the field, at one of them at least, will never drop below a fixed fraction of the maximum field $2E_0$.

In the above, the divergence coefficient and the reflection coefficient of the ground were assumed to be equal to 1 and —1 respectively. The moduli of these coefficients, however, are always less than unity, and the actual conditions are more favourable than those considered, for the oscillations of the resulting field are smaller than those given by equation (1).

These considerations may now be applied to a practical case. Suppose that it is required to design an ultra-short-wave radio link between Monte Capanne (1019 m.a.s.l.)* in the isle of Elba, and Monte Argentario (635 m.a.s.l.). In this case the propagation takes place entirely above the sea, and therefore it is justifiable to take only the two principal rays into account when calculating the field at the receiver. This radio link is particularly interesting for Italian communications as it is one possible way of connecting Sardinia with the mainland. It is not possible to use a direct link, because the receiving points would be below the line of the sight of the transmitters.

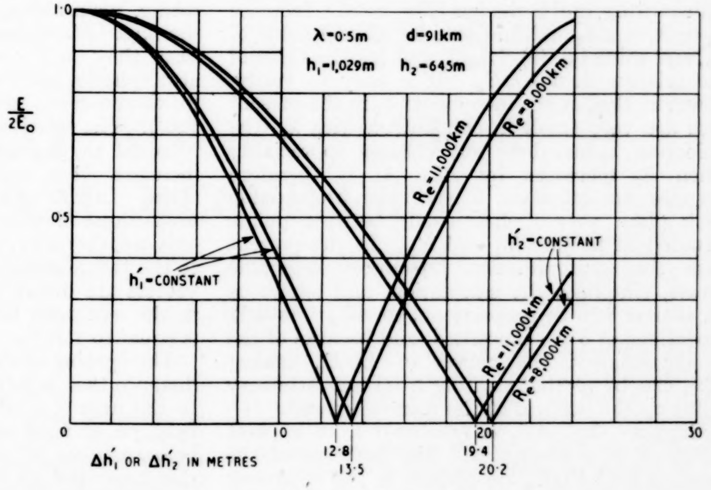

Fig. 4. *Curves relating* $E/2E_0$ *to* $\Delta h'_1$ *and* $\Delta h'_2$ *for* $\Delta h'_2$ *and* $\Delta h'_1$ *constant respectively.*

Referring to Fig. 1, and increasing the height of the transmitting and receiving points by 10 m, in order to take into account the necessary installations, we have:

$$h_1 = 1029 \text{ m}; \quad h_2 = 645 \text{ m}; \quad d = 91 \text{ km}.$$

To calculate h_1', h_2' and δ the following approximate relations[8], satisfactory in most practical cases, are used:

$$h'_1 = h_1 - d_1^2/2R_e \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

$$h'_2 = h_2 - d_2^2/2R_e \quad \ldots \quad \ldots \quad \ldots \quad (6)$$

$$h'_1/d_1 = h'_2/d_2 = \tan \psi \quad \ldots \quad \ldots \quad (7)$$

$$\delta = 2h'_1 h'_2/d \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (8)$$

Using (5), (6), (7), and taking into account the fact that $d = d_1 + d_2$, it is easy to find, by trial and error, the values of h'_1 and h'_2, and then by (8) to calculate δ.

The results of this calculation are:

$h'_1 = 843$ m; $h'_2 = 562$ m; $\delta = 10.4$ m;
for $R_e = 8{,}000$ km.

$h'_1 = 892$ m; $h'_2 = 586$ m; $\delta = 11.5$ m;
for $R_e = 11{,}000$ km.

As can be seen, δ varies by about 1.1 m when the atmospheric refractive index changes from its maximum to its minimum value. Now if it is proposed to adopt a wavelength $\lambda = 0.5$ m, it follows that during the total variation of the atmospheric refractive index there will be two cycles of fading. Obviously this happens either if the transmitting point is A and the receiving B, or if the receiving point is A and the transmitting B.

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* m.a.s.l. = metres above sea level

that ϕ increases by $\Delta\phi = 180°$ from one to the other (i.e., $\Delta h'_2 = 13.15$ m) gives a condition such that the field on at least one aerial will not fall below $2E_0 \cos 45° = 1.41E_0$.

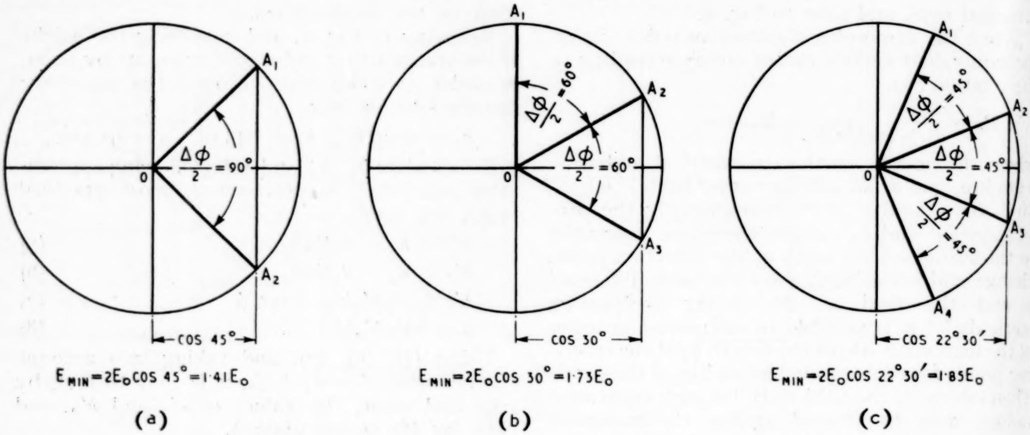

Fig. 5. *Vector diagrams showing the composition of minimum signals for (a) two, (b) three, and (c) four aerials.*

To establish the number of receiving aerials and their vertical displacement, suppose A is the transmitting, and B the receiving point. Increase h_2 to $h_2 + \Delta h_2$ and find out, for a fixed value of R_e, and using (5), (6), (7), (8) and (1), the value of the relative field $E/2E_0$. It is easy to verify, however, that as the increments h_2 in the present case are very small in comparison with h_2, the reflection point does not change appreciably when h_2 increases by Δh_2. It is therefore possible to calculate δ as if the propagation took place over a plane earth, between points situated at heights h'_1 and h'_2. In the present case the approximation introduces negligible errors, simplifies the calculation, and allows us to assume δ to be proportional to $\Delta h'_2$. As only variations of δ are concerned, and because of the proportionality, the curves of $E/2E_0$ against $\Delta h'_2$ can be plotted starting from any arbitrary point on the vertical of the receiving point.

Suppose that $\Delta h'_2$ is measured from a point where E is a maximum. The patterns of the relative field $E/2E_0$ are plotted in Fig. 4 against $\Delta h'_2$ for values of 8,000 km and 11,000 km for R_e; h'_1 is taken as constant. For these values of R_e, E varies from its maximum to its minimum value when $\Delta h'_2$ is 13.5 m and 12.8 m respectively. Taking the average of these values, it may be concluded that for a vertical displacement of 13.15 m the angle ϕ of equation (1) increases by 180°. As the field is proportional to $\cos \phi/2$, spacing the aerials by such a vertical distance

Inspection of Fig. 5 (a) makes this clearer. The two vectors OA_1 and OA_2 are supposed to rotate, maintaining their relative position, with the angle $\phi/2$ of equation (1). Therefore in this case they will rotate 360° more when the atmospheric refractive index changes from its maximum to its minimum value (ϕ increases by 720°). The relative angle between OA_1 and OA_2 is equal to the increment $\Delta\phi/2$ by which $\phi/2$ increases when moving from one aerial to the other. In this case, the increment is 90°. The projections of OA_1 and OA_2 on the horizontal axis are, therefore, proportional to $E/2E_0$ relative to the two aerials. It is easy to see that the two vectors are drawn in the position corresponding to the minimum field. On both aerials the field is equal to $1.41E_0$.

The spacing of three aerials by such a vertical distance that ϕ increases by $\Delta\phi = 120°$ from one to the next (i.e., $\Delta h'_2 = 8.7$ m), means that the field, on at least one of them, will not decrease below $2E_0 \cos 30° = 1.73E_0$. Fig. 5 (b) relates to this case, and its interpretation is analogous to that of Fig. 5 (a).

Using four aerials with vertical separations such that ϕ increases by $\Delta\phi = 90°$ from one to the next (i.e., $\Delta h'_2 = 6.6$ m) the field, on at least one of them, will not decrease below $2E_0 \cos 22° 30' = 1.85E_0$ [Fig. 5 (c)]. Obviously, the nearer the value of the minimum tolerable field is to $2E_0$, the greater is the number of aerials required, and the larger the total vertical distance occupied. In the three cases examined, the total vertical distances occupied are about : 13.15 m, 17.4 m and 19.8 m respectively.

If B is the transmitting point, by a calculation similar to the preceding one, it will be found that for $R_e = 8{,}000$ km, E changes from its maximum to its minimum value for a vertical increment $\Delta h'_1 = 20.2$ m, while for $R_e = 11{,}000$ km the increment $\Delta h'_1 = 19.4$ m (Fig 4, curves h'_2 = constant.) Therefore assuming, as before, a value corresponding to the average of the values relative to maximum and minimum equivalent radii, it can be concluded that the angle ϕ in equation (1) increases by 180° for a vertical increment of about 19.8 m. The three increments $\Delta h'_1$, corresponding to the three dispositions considered above are : $\Delta h'_1 = 19.8$ m, $\Delta h'_1 = 13.2$ m and $\Delta h'_1 = 9.9$ m respectively ; the three corresponding vertical distances occupied by the aerials are about 19.8 m, 26.4 m and 29.7 m.

3. Conclusion

From these considerations it can be concluded that the use of diversity reception in ultra-short-wave radio links has many notable advantages.

Atmospheric fading due to multipath transmission is completely avoided.[9]

Frequency distortion, when wideband modulated carriers are employed, is also reduced to a minimum.

Distortion, cross-talk and cross-modulation, that occur when frequency- or pulse-modulated carriers are used, due to the parasitic signals of considerably less strength than the principal signal, are also eliminated, or reduced, by using a suitable a.g.c. system.

In the case of radio links between very high points the use of the diversity receiving system is thought to be essential in order to obtain stable radio links. This system is particularly convenient when the direct ray is of about the same strength as the indirect one ; this obviously occurs when the intervening country is flat ground or water[10, 11].

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THERMAL NOISE OUTPUT IN A.M. RECEIVERS

Effect of Wide Pre-Detector Bandwidth

By M. V. Callendar, M.A.

1. Introduction

THE output of noise, either of impulse or thermal type, from a linear amplifier is theoretically deducible from the overall frequency characteristic (amplitude and phase) of the amplifier, without knowing the circuits or characteristics of each stage separately. This follows from the fact that the noise input may be written down in the form of a frequency spectrum, which is then operated upon by the amplifier overall characteristic to give the output noise spectrum.

On this basis, it is sometimes assumed that the overall characteristic of a complete radio receiver (as determined, for instance, by using a signal generator with variable frequency modulation) is sufficient to define the noise output. It might, for instance, be assumed that a change in i.f. bandwidth of a receiver from 20 kc/s to 200 kc/s would not alter the effective sensitivity (as determined by signal/noise ratio) provided there was no change in the audio acceptance band (say 5 kc/s).

It is, indeed, reasonable to imagine that, provided the signal carrier is much greater than the noise at the input to the detector, the various

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components of the pre-detector noise spectrum may be regarded as sidebands giving beats with the carrier. But when the signal is smaller than the noise at the detector input, we shall be hearing the beats between the various noise components rather than between them and the carrier. Under these conditions we might expect that an increase in pre-detector bandwidth would increase output noise even when the pre-detector bandwidth is much wider than the a.f. bandwidth. However, the problem is evidently not of a type readily soluble by simple or 'commonsense' methods.

Thanks to the recent mathematical (mainly statistical) work of R. E. Burgess and others on the action of a rectifier on *thermal noise*, we are now in a position to obtain a reasonably complete answer to the problem so far as thermal noise in an a.m. receiver is concerned.

We cannot deal here with the allied problems of variation of noise with bandwidth in other cases—such as thermal noise in f.m., vision or pulse receivers, or impulse noise in any receiver, in the presence of signals. Though these problems have been attacked by numerous writers, there does not seem at the moment to be a sufficient mathematical basis available for a complete or exact solution of most of them.

2. Theory

2.1 *Circuit*

A complete a.m. receiver may be represented as in Fig. 1.

E_s is r.m.s. signal at the rectifier. Fractional modulation is m.

E_o is r.m.s. noise volts per unit of frequency at the rectifier, and is assumed uniform over the band B_1.

$E_n = E_o\sqrt{B_1}$ is the total r.m.s. noise in the band B_1, as measured at the rectifier.

A is the r.f. plus i.f. amplifier gain and is assumed to be uniform over the pass band of width B_1 c/s and zero outside it. Thus, the signal at the aerial terminal is E_s/A and the noise in the band B_1 is E_n/A when referred to the aerial terminal.

V'_s and V'_n are r.m.s. noise and signal output from the rectifier, which is assumed to pass frequencies up to B_1 without loss, but to remove the radio and/or intermediate frequencies.

V_s and V_n are r.m.s. noise and signal output from the receiver, after passing through an a.f. filter and/or amplifier which is assumed to have unity gain up to a frequency B_2, and zero gain beyond this. The filter may be considered to include the frequency characteristics of the post-rectifier filters, the a.f. amplifier and the loudspeaker. The gain in the a.f. amplifier will not, of course, affect the signal/noise ratio for a given frequency characteristic. Assuming only that $B_1 > 2B_2$, any change in B_1 will not affect the output noise pulse length, and V_n may reliably be taken as a measure of the audible loudness of the noise.

It is required to find V_s and V_n for any given values of E_s, E_0, B_1 and B_2. In particular, it is required to find whether V_s and V_n are at all dependent upon the pre-detector bandwidth B_1 in cases where $B_1 > 2B_2$.

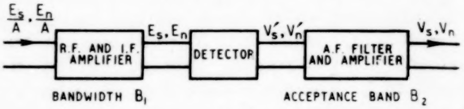


Fig. 1. *General form of an a.m. receiver.*

2.2 *Basis of Formulæ*

R. E. Burgess gives formulæ for noise and signal output from rectifiers in Radio Research Board Papers Nos. 93 and 111. The formulæ given below for V'_n and for V'_s and V_s have been derived directly from those of Burgess by inserting the appropriate symbols for signal and noise inputs to the detector. The formulæ for V_n are obtained from V'_n as follows :—

(i) For $E_s < 0.25E_n$ approx. the output power spectrum is given by $(1 - f/B_1)$;

$$\text{whence } \frac{V_n^2}{V'^2_n} = \frac{\int_0^{B_2}(1 - f/B_1)\partial f}{\int_0^{B_1}(1 - f/B_1)\partial f} = \frac{2B_2}{B_1}\left(1 - \frac{B_2}{2B_1}\right)$$

(ii) For $E_s > 2E_n$ approx. the spectrum is uniform up to $\frac{B_1}{2}$ and zero beyond this.

$$\text{Thus } \frac{V_n^2}{V'^2_n} = \frac{2B_2}{B_1},$$

assuming only that $B_2 < \frac{B_1}{2}$

(iii) For intermediate values of E_s/E_n, the spectrum is intermediate in form and not simply describable.

2.3 *Linear Detector*

The internal impedance is assumed negligible.

(a) *Signal* $\ll$ *Noise* (error $<$ 1 db for $E_s < 0.25E_n$)

$$V'^2_n = 0.43\ E_0^2B_1$$
$$V_n^2 = 0.43\ E_0^2B_2(2 - B_2/B_1)$$
$$V_s^2 = V'^2_s = m^2E_s^2 \,.\, E_s^2/E_0^2B_1$$

(b) *Signal* $\gg$ *Noise* (error $<$ 1 db for $E_s > 2E_n$)

$$V'^2_n = E_0^2B_1$$
$$V_n^2 = 2E_0^2B_2$$
$$V_s^2 = V'^2_s = m^2E_s^2$$

(c) *Signal and Noise of Same Order*

No exact formulæ available.

2.4 *Square-Law Detector*

D.C. characteristic is $V = aE^2$

(a) *Signal* $\ll$ *Noise* (error $<$ 1 db for $E_s < 0.25E_n$)

$$V'^2_n = 4a^2E_0^2B_1^2$$
$$V_n^2 = 4a^2E_0^4B_2(B_1 - 0.5B_2)$$
$$V_s^2 = V'^2_s = 8a^2m^2E_s^4$$

(b) *Signal* $\gg$ *Noise* (error $<$ 1 db for $E_s > 2E_n$)

$$V'^2_n = 8a^2E_0^2E_s^2B_1$$
$$V_n^2 = 16a^2E_0^2E_s^2B_2$$
$$V_s^2 = V'^2_s = 8a^2m^2E_s^4$$

(c) *Signal and Noise of Same Order* (general formula)

$$V'^2_n = 4a^2(2E_s^2 + E_0^2B_1)$$
$$V_n^2 = 4a^2(2E_s^2 + E_0^2B_1)E_0^2B_2(2 - B_2/KB_1)$$
$$V_s^2 = V'^2_s = 8a^2m^2E_s^4$$

Here K varies from 1 for $E_n \gg E_s$ to ∞ for $E_s \gg E_n$.

2.5 *Signal/Noise Ratios*

Deriving now the output signal/noise ratio, we have :—

(a) *Signal* $\ll$ *Noise* ($E_s < 0.25E_n$)

For Square-Law Rectifier

$$\frac{V_s}{V_n} = \frac{mE_s^2}{E_0^2}\sqrt{\frac{1}{B_2(B_1 - 0.5B_2)}}$$

For Linear Rectifier $\dfrac{V_s}{V_n}$ is as for square law except for a slight difference in the constant (+ 7%).

(b) *Signal* $\gg$ *Noise* ($E_s > 2E_n$)

For either type of Rectifier

$$\frac{V_s}{V_n} = \frac{mE_s}{E_0\sqrt{2B_2}} = \frac{mE_s}{E_n}\sqrt{\frac{B_1}{2B_2}}$$

(c) *Signal and Noise of Same Order*

For Square-law Rectifier

$$\frac{V_s}{V_n} = \frac{mE_s}{E_0\sqrt{2B_2}} \cdot \frac{1}{\sqrt{1 + E_0^2B_1/2E_s^2}}$$

with a small correction ($<$ 1 db) when $2B_2$ approaches B_1 ;

For Linear Rectifier no exact formulæ are available, but results are probably very similar.

2.6 *Signal/Noise ratio* v. *Bandwidth*

From the formulæ we may summarize the way in which the signal/noise ratio varies with B_1 as follows (we assume only that $B_1 > 2B_2$) :—

(a) When the signal is materially greater than the noise at the rectifier input, the signal/noise ratio is always unaffected by the pre-detector bandwidth B_1.

(b) When the signal is much smaller than the noise at the rectifier, the signal/noise voltage ratio is proportional to

$$1/\sqrt{(B_1 - 0.5B_2)}.$$

In the case of the square-law detector, this variation in signal/noise ratio is due to the fact that the noise output volts increases as $\sqrt{B_1 - 0.5B_2}$; with a linear detector, on the other hand, the noise output is unaffected by B_1, but the signal modulation is suppressed to a degree dependent upon E_n and hence upon B_1.

(c) As the bandwidth B_1 is increased, starting from $B_1 = 2B_2$, the signal/noise ratio for a given signal will not start to fall until the noise ($E_0\sqrt{B_1}$) voltage at the detector rises to half the signal voltage at that point.

(d) Since $\dfrac{V_s}{V_n} = 1.4m\sqrt{\dfrac{B_1}{B_2}}$ when $E_n = 0.5E_s$, we see that a reduction of B_1 will not improve signal/noise ratio except on signals so weak that the noise output exceeds that given by $\sqrt{B_2/2B_1} \times 100\%$ modulation of the signal. The improvement will not be really noticeable in practice unless the noise is some 10 db above this level.

2.7 *Graphical Presentation of Results*

Figs. 2 and 3 exhibit the relations in graphical form. They should be used in conjunction with the following notes :—

(i) Noise output for values of B_2 other than 10^4 may be obtained by multiplying noise figures obtained from the graphs by $10^{-2}\sqrt{B_2}$. The form of the curves is unaltered.

(ii) The graphs, with the above extension, hold for any values of B_1 and B_2, provided that $B_1 > 2B_2$ (apart from the small error not exceeding 1 db which occurs when $E_n > E_s$ and B_1 approaches $2B_2$).

(iii) Though B_1 does not appear explicitly in Fig. 3, it must be borne in mind that E_n is proportional to $\sqrt{B_1}$.

(iv) The rectifier in Fig. 3 is assumed linear when E_s or E_n exceeds 1.0 volt, and square law, with $a = 0.9$, when E_s and E_2 are both below 0.2 volt. These figures are typical for diode detectors.

(v) The curved portions of the graphs representing values of input between 0.2 and

1.0 volt, and values of E_n/E_s between 0.25 and 2.0, must be regarded as approximate only. Little purpose would, in any case, be served by attempting a high accuracy here, since practical detectors will deviate appreciably from the ideal types, especially near the transition region between parabolic and linear rectification.

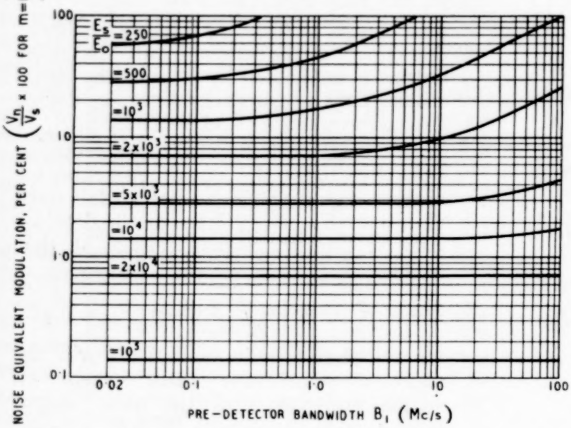


Fig. 2 (left). *Variation of noise/signal ratio with pre-detector bandwidth. For an a.f. bandwidth* (B_2) *of* 10 *kc/s, at various values of signal carrier.*

2.8. *Effect of Pre-detector Bandwidth*

If we consider instead the change of output signal/noise ratio with *signal level* E_s: the formulæ show that, for normal signal levels, such that $E_s > 2E_n$, the signal/noise ratio varies as $1/E_s$, but when E_s falls below $0.25E_n$ the signal/noise ratio varies as $1/E_s^2$. Thus there exists a *threshold* value of signal level below which the output signal/noise ratio deteriorates rapidly. This threshold is analagous to the better known threshold levels found in analyses of frequency-modulated or pulse-modulated signals: in all cases the threshold occurs when the signal amplitude is of the same order as the noise at the detector, but the phenomenon is more noticeable in practice with f.m. and p.m. receivers owing to the 'capture effect' exerted by the noise once the signal is below threshold, and to the wider bandwidth usually employed there.

We also see that, whereas the signal/noise ratio for normal signal levels is controlled by the post-detector bandwidth B_2, this threshold level is controlled by the pre-detector bandwidth B_1 and is unaffected by B_2. It is the ratio B_1/B_2 that determines whether the threshold occurs at a level where the signal/noise ratio would otherwise be acceptable, or whether the threshold signal would be too poor for intelligible reception.

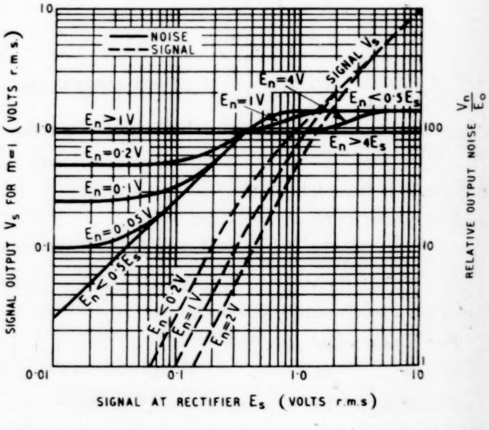
The actual signal field level for threshold depends, of course, upon factors outside the scope of this paper; the threshold signal at the aerial terminal is approximately equal to the noise (in the band B_1) referred to the same point.

It is worth noting that the signal/noise ratio of signals below the threshold could be improved by adding a synthetic carrier at the receiver, though its synchronization might be difficult.

3. Practical Conclusions

As a practical case, we may first take a typical *t.r.f. television sound receiver*, with relatively high fidelity a.f. amplifier and loudspeaker reproducing up to 10 kc/s. If the r.f. bandwidth is 1 Mc/s for − 6 db, a reduction in bandwidth will only improve signal/noise ratio in the case of transmissions where the r.m.s. noise output exceeds that from about 7% modulation of the signal. The improvement will reach about 3 db for transmissions so weak that the noise equivalent modulation is 20%, but most broadcast programmes would not, in any case, be worth listening to with this level of noise. Thus the r.f. bandwidth for such sets may safely be as much as 0.5 Mc/s.

Fig. 3 (below). *Variation of noise and signal with signal input to the rectifier. For an a.f. bandwidth* (B_2) *of* 10 *kc/s, with various values of noise input* ($E_n = E_0\sqrt{B_1}$) *to the rectifier.*



If instead we take a *telephony communication receiver* where intelligibility (and not high quality) is the criterion, and the a.f. band is narrower (say $B_2 = 2$ kc/s), an increase in pre-detector bandwidth from 10 kc/s to 1 Mc/s would have more noticeable practical effects: e.g., the noise would be increased 6 db on a signal where the noise modulation was originally 16%, making the difference between an intelligible signal and one more or less non-intelligible. Thus the r.f./i.f. bandwidth of such sets should not exceed about 200 kc/s.

Finally, in the case of a *telegraphy receiver* where the a.f. band may be very narrow (say, 100 c/s) and signals are readable up to about 100% noise modulation, it is evidently very important to keep the pre-detector bandwidth down to two or three times the a.f. bandwidth. An increase in pre-detector bandwidth from 200 c/s to 10 kc/s, for example, would increase noise/signal ratio by 16 db on the original minimum signal and the signal would have to be increased by 8 db to make it again readable.

NEW BOOKS

Ionospheric Radio Propagation

U.S. Department of Commerce, National Bureau of Standards, Circular 462. Pp. 209, with 205 illustrations. Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. Price $1 (postage abroad 33 cents.).

This book is the most comprehensive work on the practical *use* of ionospheric data so far published, and it also expounds the theories of radio-wave propagation upon which the techniques for applying such data are based. The theoretical treatment is not intended to be comprehensive, the object being rather to present, in a relatively simple manner, enough of the theory to enable the ensuing techniques to be understood. These latter are dealt with in great detail but, although the book is profusely illustrated by charts, graphs, nomograms and other diagrams, it is not sufficient by itself to enable radio-propagation calculations in various parts of the world to be made. This is because of the constantly changing nature of the ionosphere, which thus necessitates the use of up-to-date data on its characteristics. Nevertheless numerous examples of such calculations are given, so that the principles and methods employed are made clear.

Chapter 1 is merely an explanation of the scope and purpose of the book, while in Chapter 2 the theory of wave propagation is dealt with. In Chapter 3 the technique of ionospheric measurement is described, and also that of the measurement of other atmospheric phenomena which affects radio transmission and reception, the principles of the equipment employed being briefly dealt with. Chapter 4 describes the main features of the ionospheric structure, as it exists all over the world, so far as this is known. Some rather daring assumptions have been made about the distribution of the ionization in the southern hemisphere, where the actual distribution and its relation to that in the northern hemisphere is, to say the least of it, far from clear. Nevertheless the main details of the world-wide ionospheric structure are fairly satisfactorily explained.

Chapter 5 describes the complex variations of the ionosphere with time, including those due to the sunspot cycle. In his endeavours to bring out the significant points about this phenomenon the author seems to have become somewhat prone to exaggeration as, for example, when he states that the sunspot relative number is zero for *months* at a time. The chapter contains a good description of the two kinds of ionospheric disturbance. Chapter 6 is very important, for it contains an excellent explanation of the methods for finding the maximum-usable frequencies for any path at any time, including full details of the operational procedures for doing this work, some of which, it is explained, have not been established from the theory.

Chapters 7, 8 and 9 are devoted to all those phenomena which affect the l.u.h.f. (lowest useful high frequency) or, alternatively, the l.r.r.p. (lowest-required radiated power). The calculation of these quantities is by far the most complicated of all ionospheric operational requirements, involving such things as ionospheric absorption, fading, radiated power, different forms of radio noise, aerials and set performance. The whole subject is deal with at considerable length, and some very useful graphs and diagrams are included. Though one may be impressed by the ingenuity of the techniques employed, one cannot help being struck by the complexity of the subject and by the amount of labour involved. In fact, no one but a specialist short-wave engineer can be expected to have a complete command of all this involved business, which is not at all surprising, when one considers the medium with which one is dealing.

To return to the book—it is a valuable summary of current ionospheric knowledge and an exhaustive description of the practical application of this to everyday short-wave work. It is thus an almost indispensable book for the ionospheric worker and for the specialist short-wave engineer, while it contains much that should be of use and interest to the less specialized engineer, and to the radio student.

T. W. B.

Velocity-Modulated Thermionic Tubes

By A. H. W. Beck. Pp. 180 + x, with 55 illustrations. Cambridge University Press. Price 15s.

This is the latest of the monographs on Modern Radio Technique, edited by J. A. Ratcliffe. In common with the other volumes of the series, it aims at describing for the benefit of the non-specialist physicist and engineer the important advances made since 1939. Mr. Beck's contribution is concerned with electronic devices which were practically non-existent before the war, and to that extent it is justified.

After a very brief description of the principle of velocity-modulation of an electron beam and an equally brief mention of the chief types of tubes in use today, the author devotes a chapter to resonators and another to the general theory of velocity variation. He then directs attention to the problems associated with high current beams by discussing the electron-optics of focusing and proceeds in Chapters 5, 6 and 7 to describe the more important effects encountered in amplifiers, frequency multipliers and oscillators, the first two being dismissed in one chapter. The two-resonator klystron oscillator and the reflex oscillator are given a chapter each and within the space at his disposal Mr. Beck has succeeded in discussing several interesting aspects of these important valves. The less important or less successful valves are described in Chapter 8, while the outstanding problems presented by tubes built to operate on the new principles are brought to the reader's attention in Chapter 9. Chapter 10, perhaps the most interesting of all, is concerned with the design and manufacture of tube components and here, although only 9,000 words are employed, much useful information is conveyed regarding the new techniques and possible future developments. There are two interesting appendices, the first being an example of how a high-powered klystron might be designed and the second a short dissertation on the travelling-wave tube.

In writing the book Mr. Beck had a difficult problem, for it was far from clear at the time of writing how much or how little of the American work should be included. In fact the author has chosen to neglect much of it, and it is perhaps fortunate that what he has omitted is available in three separate volumes published in the U.S.A. since the war. The useful, if less voluminous contribution made by France and this country to v.m. theory is adequately discussed.

The author is to be congratulated on a text singularly free from errors and misprints. On occasion his symbolism is not altogether logical, but that is a fault which he shares with many famous technical authors. It is on the application of v.m. tubes that Mr. Beck's opinions are, perhaps, controversial. To mention a particular example, frequency modulation of a v.m. oscillator and subsequent amplification of the modulated wave is not such a simple matter as he makes out : the amplifier can and does introduce an unwanted phase modulation. On the other hand, amplitude modulation of a high power c.w. klystron oscillator is a technical possibility, although it is hard to visualize for what purpose such an amplitude-modulated signal would be required.

J. T.

Handbook of Industrial Electronic Circuits

By John Markus and Vin Zeluff. Pp. 272 + xv. McGraw Hill Publishing Co. Ltd., Aldwych House, London, W.C.2. Price 39s. (in U.K.).

The contents of this book comprise circuits ,which in most cases show typical values of components, together with short explanatory notes. The page size is unusually large (8½ in × 11 in) and a typical page contains two circuits.

The word 'Industrial' in the title is interpreted very liberally and the subjects covered include audio-frequency, capacitance control, cathode-ray, control, counting, direct current amplifier, electronic switching, limiter, measuring, metal locating, motor control, multivibrator, oscillator, photo-electric, power supply, stroboscopic, telemetering, temperature control, timing, ultrasonic, voltage regulator and welding control circuits.

In the preface the authors state that "To compile this material, all pertinent magazines were searched page by page. . . . As a result, some four hundred and forty circuits were assembled for processing." Had the word 'American' been inserted before 'magazine' we should have no quarrel with this statement, but it is obvious that only American journals have been searched for there are only three references to others and in each of these the original paper was abstracted in an American journal.

As a result there are many important omissions. No mention of the Miller Integrator is to be found, for instance, although quite a number of other 'linear' sweep circuits are included. A fault of the treatment is that no indication is given of what factor in the circuit is of major importance. However, this may be more a fault of the original articles, for these abstracts do not pretend to be in any way critical.

Within the limitations mentioned the book is a useful reference guide to circuits and will serve to refresh one's memory of ways of doing things. Only rarely will it be possible to lift a circuit intact.

W. T. C.

F.B.I. Register

The 1948/49 edition of the F.B.I. Register of Manufacturers is the only complete guide to members of the Federation of British Industries. In nearly 1,000 pages are listed 6,000 firms and their products together with address, brands and trade mark sections. French and Spanish reference facilities are included.

Priced at 42s. the book is obtainable from Kelly's Directories Ltd., 196, Strand, London, W.C.2. (home) and Iliffe & Sons Ltd., Dorset House, Stamford St., London, S.E.1 (overseas).

Wireless World Great Circle Projection Map.

Size 27 in × 34 in. Iliffe & Sons Ltd., Dorset House, Stamford St., London, S.E.1. Price 2s. 6d. (postage 6d.)

A great-circle projection map based on London and giving therefrom the true bearing and distance of any point in the world.

Prevention of Iron and Steel Corrosion

By C. Dinsdale, M.Sc., F.I.M. Pp. 67. Iliffe & Sons Ltd., Dorset House, Stamford St., London, S.E.1. Price 5s.

An index of methods of preventing corrosion and of connected specifications. The cleansing of metal parts and codes of practice are also dealt with.

Radio Mains Supply Equipment

By E. M. Squire. Pp. 182 + vii with 166 illustrations. Sir Isaac Pitman & Sons Ltd., Kingsway, London, W.C.2. Price 12s. 6d.

INDEXES

As is our custom the Index to the Articles and Authors for the current volume is included in this issue.

The Index to the Abstracts and References published throughout the year is in course of preparation and will, it is hoped, be available in February, priced 2s. 8d. (including postage). As supplies will be limited our Publishers ask us to stress the need for early application for copies.

CRYSTAL CALIBRATION SERVICE

Salford Electrical Instruments Ltd., have started a frequency-calibration service for quartz crystal units of either their own or other makes. The accuracy of the measurement of frequency is stated to be at least 5 parts in a million and of activity to 5%.

The service is limited to certification of frequency but a measurement of crystal activity will be quoted for a circuit capacitance of 30 pF. However, if the customer specifies his requirement when forwarding a crystal, frequency and activity can be quoted for alternative capacitances of 20 pF or 50 pF or, in the case of low-frequency types, at series resonance.

The repair or regrinding of units which are not of Salford manufacture cannot be undertaken. The charge for calibration is 5s. per crystal, including return postage, and a remittance should accompany the crystal which should be sent by registered post to Salford Electrical Instruments Ltd., Q.C. Dept., Birch Mill, Birch in Hopwood, Heywood, Lancs, and marked 'Frequency Calibration Service.'

CORRESPONDENCE

Letters to the Editor on technical subjects are always welcome. In publishing such communications the Editors do not necessarily endorse any technical or general statements which they may contain.

Relatively-Moving Charge and Coil.

SIR,—In his Editorial in the September 1948 issue, Professor Howe discusses the problem of the calculation of the e.m.f. induced in a coil by a relatively-moving charge. Everyone agrees that the e.m.f. should depend only on the relative velocity of coil and charge, yet difficulties arise when classical theory is applied in the case of stationary charge and a moving coil.

The key to the problem lies in the effect of the surface charges electrostatically induced on the coil by the acting charge, for in the absence of such charges everyone will admit that classical theory gives a result inconsistent with the principle of relative motion. Fig. 1 shows the case of a stationary coil and a moving charge. If the coil is a single loop of thin wire, negative charges will be induced on the outer surface in the neighbourhood of A, and positive charges on the inner surface. Near B the reverse will be true, and positive charges will be induced on the outside. If the loop is a *tube* then the induced charges will be solely on the outer surface.

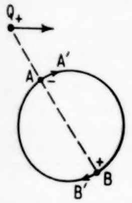


Fig. 1

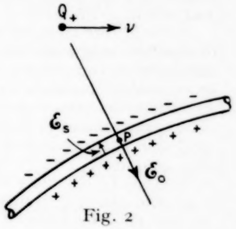


Fig. 2

We can regard the surface charges as being centred at the points A and B, the total negative charge being equal in magnitude to the total positive charge. Then as the acting charge Q moves, the surface charges move around the coil towards A′ and B′. The motion of the charges does not constitute any closed current around the loop, and the net magnetic flux linking the loop from the effect is zero.

Thus the motion of the surface charges in this case induces no e.m.f. in the loop, and the sole e.m.f. arises from the magnetic field of the acting charge Q.

Now consider the case in which the acting charge is stationary and the coil is moving, the *relative* velocity of the two being exactly the same as before. Then the magnitude and motion of the induced surface charges relative to the loop are also the same as before. Can it be possible that these charges now induce an e.m.f. in the coil when hitherto they did not ? Surely such a result would itself be at variance with the principle of relative motion.

Let us therefore look more closely at the magnetic field set up by the surface charges when the coil is moving. Fig. 2, of Professor Howe's editorial shows a negative charge on the coil near the acting charge and a positive charge on the remote side. But this is not the state of affairs if the coil is a single loop of very thin wire.

Fig. 2 shows the acting charge Q and a segment of a large coil of thin wire. Let the electrostatic field of Q at a point P, in the absence of the conducting wire, be $\mathcal{E}_o$. Then if P is inside the conductor the induced surface charges must be such as to set up a component of electrostatic field at P which exactly cancels $\mathcal{E}_o$. That is, we have $\mathcal{E}_s = -\mathcal{E}_o$. .. .. .. (1)

Now in the case of moving charge, stationary coil the magnetic field of Q at P is given by :

$$\mathbf{B}_1 = \frac{\mathbf{v} \times \mathcal{E}_o}{c^2} \qquad \text{.. .. .. (2)}$$

The surface charges, moving about on the wire, cause a magnetic field $\mathbf{B}_r$ at P, so that the total field is :

$$\mathbf{B} = \mathbf{B}_1 + \mathbf{B}_r \qquad \text{.. .. .. (3)}$$

In the complementary case when Q is stationary and the coil moves with velocity $-\mathbf{v}$, the surface charges have a constant component of velocity $-\mathbf{v}$ so that their magnetic field is now :

$$\mathbf{B}_s = -\frac{\mathbf{v} \times \mathcal{E}_s}{c^2} + \mathbf{B}_r$$

$$= \mathbf{B}' + \mathbf{B}_r = \mathbf{B} \qquad \text{from (1), (2), (3).}$$

Thus the magnetic fields *inside* the conductor are the same in both cases, but this is not true at points *outside* the conductor and the flux linking the coil is therefore not the same.

Fig. 3 is a rough sketch of the configuration of the component of field $\mathbf{B}' = -\dfrac{\mathbf{v} \times \mathcal{E}_s}{c^2}$ of the surface charges. Within the conductor the lines of force are perpendicular to the lines of force of $\mathcal{E}_s$, and complete their closed paths through the exterior space as shown. The field through the loop is thus very different from the field $\mathbf{B}_1$ of the acting charge in the first case.

Logical application of Maxwell's equations seems to show that no e.m.f. is induced either by the surface charges or by the stationary acting charges. No doubt the proper application of Einstein's theory would resolve the inconsistency. This would involve non-simultaneity at different points of the moving loop in calculating the e.m.f. The problem seems to provide an exception to the accepted principle that Maxwell's theory does not require the assistance of Einstein except when velocities are comparable with the velocity of light. In *Electrical Engineering*, May 1947, I showed that it should be possible to measure the e.m.f. at a speed as low as 100 metres per second.

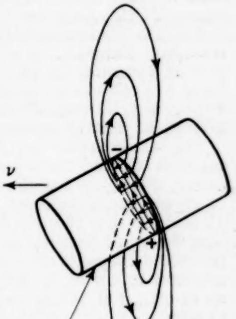


Fig. 3

Turning now to the question of the conservation of energy, I would first note that neither Fig. 4 nor Fig. 5 of Professor Howe's Editorial provides a practical method of obtaining an isolated charge in motion. The pulse in Fig. 4, will be established around the circuit almost instantaneously; that is, for the duration of the pulse we have a closed conduction current. Also, with the shortest pulses used at present with cathode-ray tubes, the pulse duration is much greater than the transit time of an electron in the tube. Again, we would have what is practically a direct current flowing through the tube, and round the circuit, during the pulse.

Fig. 4 shows a charge Q moving along the axis of a toroidal coil, so that part of the magnetic field of Q links the turns of the toroid. As the charge approaches, an e.m.f. is induced in the coil in the direction shown. Suppose the circuit is closed; then the induced current as it *grows* will induce an electric field along the axis of the toroid *in the direction of motion of* Q. That is, the effect is to *accelerate* the charge, and not to retard it. As soon as the current passes its maximum and commences to fall, the induced force on Q reverses and the charge will then be retarded. Where does the energy come from, when the current is increasing, to accelerate the charge, and also supply the ohmic loss in the coil? According to Maxwell's theory it comes from the *magnetic field* of the moving charge. There is an exact balance of energy but, and I think this point is significant, the whole hypothesis seems to depend on the real existence of a store of magnetic energy localized in the space surrounding the charge, and many scientists (Jeans in particular) have told us that this idea is not really tenable in the light of modern physical knowledge. If, then, we must abandon the idea of stored energy in the aether (as distinct from radiation), there does appear to be an anomaly in the conservation of energy in this problem.

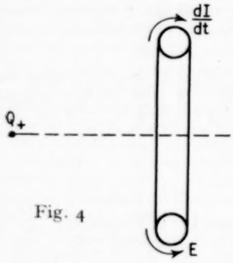


Fig. 4

There is also trouble in the inequality of action and reaction. Suppose, in Fig. 4, that a constant current I is maintained in the toroid by an external source. Then as Q moves along the axis of the coil it *experiences no magnetic or induced force whatever*, whereas it exerts a *magnetic force of repulsion* on the toroid.

The explanation by Maxwell's theory is that the reaction to the force on the toroid is borne by the *aether*, but again I understand that no modern physicist of repute really believes this at the present day. Thus I conclude that the problem is well worth further study. The theory of Ritz has possibilities, but fails in this very problem because it gives no reaction on the toroid, and a reaction is certainly required in the case in which a short-circuited toroid moves relatively to a stationary charge.

E. G. CULLWICK

Dept. of Defence, Ottawa.

Ring-Aerial Systems

SIR,—I wish to correct an error in my paper "Ring Aerial Systems: Minimum Number of Radiators Required," which appeared in the October 1948 issue of *Wireless Engineer*.

In the second paragraph on page 311, reference is made to the directions in which polar diagram maxima and minima occur. These are in error by 90°, due to the fact that, in Fig. 3, OC is at right angles to the reference direction, namely the projection of OP in the horizontal plane.

The last sentence of this paragraph should, therefore, read as follows:

"If s exceeds n by an even number, there will be polar diagram maxima at right angles to the direction of individual aerials, the right angle being measured in the direction of phase rotation; if s exceeds n by an odd number, there will be corresponding polar diagram minima in these directions."

H. PAGE.

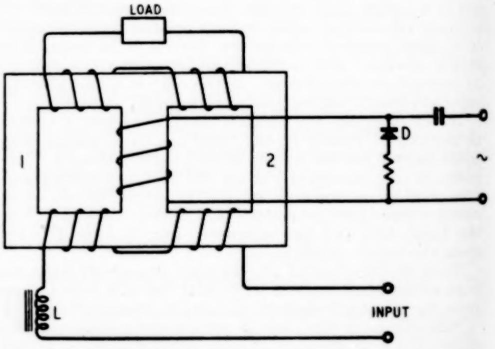
British Broadcasting Corporation,
Hinksey Hill, Oxford.

Simplified Magnetic Amplifier

SIR,—I would like to refer to D. A. Bell's letter on magnetic amplifiers which appeared in your September issue. In Fig. 3 of this letter is shown a circuit in which the standing current for zero signal is balanced in the output by using two iron cores only, in a parallel resonant circuit. This circuit goes out of resonance when a d.c. input signal is applied and so gives an alternating current into the load.

I would like to draw your attention to another type of simplified magnetic amplifier circuit which gives perfect balance of output current for zero signal input, proportionality between output and input, as well as discrimination in the response to inputs of different polarity.[1] The arrangement is shown in the accompanying diagram, and d.c. magnetization in the two arms (1) and (2) of the magnetic circuit is produced by the rectifier D connected to the main a.c. winding.

In the absence of any input signal, there is no current in the load because of the symmetry of the magnetic circuits and of the opposing halves of the output windings.



When a d.c. input signal is applied, this reduces the d.c. magnetization in one arm of the magnetic circuit and increases it in the other. This causes the e.m.f. in one half of the output winding to increase and that in the other to decrease thus giving a differential alternating current in the load. When this is rectified, it is seen that its effect is to aid the cause for an input of one polarity and to oppose it for an input of the opposite, and this gives discrimination between the two cases.

The choke L prevents the alternating current in the output from being induced into the input.

M. MARINESCU.

Electrical Communication Laboratory,
Polytechnic School, Bucarest.

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[1] "Amplificateurs Magnétiques," M. Marinescu, *Acad. Roumaine, Bull. de la Section Scientifique*, T.XXVIII, No. 3, 1945.

WIRELESS PATENTS

A Summary of Recently Accepted Specifications

The following abstracts are prepared, with the permission of the Controller of H.M. Stationary Office, from Specifications obtainable at the Patent Office, 25, Southampton Buildings, London, W.C.2, price 2/- each.

DIRECTIONAL AND NAVIGATIONAL SYSTEMS

595 832.—Radiolocation system in which the exploring beam is automatically swung over a given terrain by cyclically varying the frequency fed to an aerial array.

Marconi's W.T. Co. Ltd. (assignees of I. Wolff). Convention date (U.S.A.) 23rd April, 1943.

595 837.—Directional aerial comprising a hollow horizontal boom, pivoted centrally, and carrying at each end a transverse loop which is suitably tilted to offset undesired coupling effects.

A. H. Stevens (communicated by United Air Lines Inc.). Application date 13th June, 1944.

595 893.—Waveguide coupling and feed arrangement for a parabolic aerial designed to radiate a fan-shaped beam, particularly for airborne radiolocation sets.

Western Electric Co. Inc. Convention date (U.S.A.) 26th July, 1944.

596 314.—Radiolocation system in which the scanning beam describes a cone in space, and provision is made to ensure the accurate tracking of a moving target.

Western Electric Co. Inc. Convention date (U.S.A.) 24th February, 1944.

596 391.—Aerial array in which parasitic radiation from asymmetrically-arranged elements is utilized to increase the sharpness of the directional pattern.

Standard Telephones and Cables Ltd. (assignees of S. B. Pickles). Convention date (U.S.A.) 15th November, 1943.

596 442.—Aerial system comprising inner and outer pairs of suitably-phased dipoles for marking out a navigational course of the overlapping-beam type.

Marconi's W.T. Co. Ltd. (assignees of G. H. Brown). Convention date (U.S.A.) 30th September, 1941.

596 447.—Navigational equipment in which radiolocation is combined with gyroscopic control to indicate and correct any drifting from a set course.

Western Electric Co. Inc. Convention date (U.S.A.) 21st March, 1944.

596 479.—Feeding and screening arrangements for reducing the effect of parasitic currents in directive aerials of the Adcock type.

Standard Telephones and Cables Ltd. (assignees of H. G. Busignies). Convention date (U.S.A.) 2nd June, 1942.

596 515.—Radiolocation receiver with an input circuit which is designed to discriminate against ground and other undesired echo signals of large pulse width.

S. Jefferson and K. Hopkinson. Application date 27th July, 1945.

596 611.—Group of three spaced loop aerials, one central and periodically switched, forming a directive unit which is free from polarization error.

F. Tench (communicated by Automatic Electric Laboratories Inc.). Application date 29th June, 1945.

596 614.—Elevated four-loop aerial beacon for radiating two crossed figure-of-eight patterns of plane-polarized waves.

Standard Telephones and Cables Ltd. (assignees of N. Marchand). Convention date (U.S.A.) 22nd July, 1944.

596 657.—Radiolocation system of the kind in which the Doppler effect is utilized to distinguish the echo signals from a moving target, particularly on a plan-position indicator.

A. E. Bailey and E. H. Rhoderick. Application date 19th February, 1945.

596 691.—Mobile direction finder in which a true indication is secured by analysing the relation between in-phase vectors at selected points on a stationary interference pattern.

Standard Telephones and Cables Ltd. (communicated by International Standard Electric Corp.). Application date 17th July, 1945.

596 804.—Direction-finding system in which a true indication is secured by opposing the separate signals received on horizontally and vertically polarized aerials.

Standard Telephones and Cables Ltd. (assignees of H. G. Busignies). Convention date (U.S.A.) 22nd January, 1943.

597 052.—Time base and potentiometer arrangement designed to increase the accuracy of short-range measurements in radiolocation.

J. W. Pletts. Application date 2nd May, 1945.

597 094.—Radiolocation system of the kind in which the Doppler effect is utilized to distinguish the echo-signals received from fixed and moving objects, particularly on a plan-position indicator.

A. E. Bailey. Application date 9th March, 1945.

597 184.—Gate circuit controlled by a strobing voltage for selecting a given echo-signal in radiolocation equipment.

R. S. Webley. Application date 31st July, 1945.

597 258.—Phase-changing devices for varying the effective length of a waveguide, used say for swingnig the exploring beam in radiolocation.

E. Pickup, G. E. Bacon and P. H. T. Brook. Application date 14th July, 1945.

RECEIVING CIRCUITS AND APPARATUS

(*See also under Television*)

595 805.—Relay arrangement for preselecting one or more of the separate items broadcast on a given wavelength, provided each item is preceded by a characteristic pulsed signal.

Electrical Components Ltd. and W. Sommer. Application date 15th June, 1945.

596 439.—Construction and application of a cavity-resonator device for automatic frequency stabilization or modulation, or for tuning-control.

" Patelhold " Patentverwertungs &c. A.G. Convention date (Switzerland) 6th November, 1943.

596 519.—Receiver comprising a pair of series-resonant circuits for detecting phase or frequency modulated signals.

Marconi's W.T. Co. Ltd. (assignees of G. L. Usselman). Convention date (U.S.A.) 28th July, 1944.

596 531.—Receiver for frequency-modulated signals in which incidental amplitude variations are applied, through gain-control, to counteract themselves.

Marconi's W.T. Co. Ltd. (assignees of N. I. Korman). Convention date (U.S.A.) 29th July, 1944.

596 617.—Receiver with 'stepped' tuning which periodically sweeps over a wide frequency range in order to detect and locate any station operating within that range.

Standard Telephones and Cables Ltd. (assignees of A. Preisman). Convention date (U.S.A.) 7th May, 1943.

TELEVISION CIRCUITS AND APPARATUS

FOR TRANSMISSION AND RECEPTION

595 937.—Cathode-ray receiver for photographic and like facsimile signals.

W. G. H. Finch. Convention date (U.S.A.) 25th March, 1944.

596 011.—Television system in which the audible components take the form of time-modulated pulses transmitted immediately after each synchronizing signal.

Standard Telephones and Cables Ltd. (assignees of T. H. Young, Junr.). Convention date (U.S.A.) 17th July, 1944.

596 026.—Receiving circuit for time-modulated pulsed signals, particularly those forming part of a television programme.

D. I. Lawson and Pye Ltd. Application dates 14th July and 12th October, 1945.

596 106.—Relaxation oscillator for receiving pulsed signals forming part of a combined sound-and-television waveform.

A. V. Lord, J. E. Cope and Pye Ltd. Application date 19th July, 1945.

596 394.—Television mixing circuit in which the video, audio, blanking, and synchronizing signals are separately applied to selected grids in a two-stage amplifier.

Farnsworth Television and Radio Corpn. Convention date (U.S.A.) 5th February, 1944.

596 459.—Valve circuit of the counter type arranged as a receiver for frequency-modulated signals extending over a wide range, as in television.

E. L. C. White. Application date 29th June, 1945.

597 050.—Automatic gain-control system for television, in which the correct background conditions are maintained over changing contrasts in light and shade.

Farnsworth Television and Radio Corp. Convention date (U.S.A.) 1st July, 1944.

597 234.—Television scanning system in which both the line and frame frequencies are derived from different harmonics of a primary oscillation of distorted waveform.

Farnsworth Television and Radio Corpn. Convention date (U.S.A.) 18th November, 1943.

TRANSMITTING CIRCUITS AND APPARATUS

(See also under Television)

596 877.—Transmission circuit including both a linear and a non-linear amplifier for separating and regulating the carrier and sideband components of a modulated wave

Sperry Gyroscope Co. Inc. Convention date (U S.A.) 3rd May, 1944.

596 924.—Modulating device comprising two waveguide sections coupled through a balanced bridge and a pair of gratings for rotating the plane of polarization.

Western Electric Co. Inc. Convention date (U.S.A.) 16th June, 1944.

597 240.—Forming an offset junction or coupling between two rectangular waveguides through an intermediate guide section of circular cross-section.

J. B. Warren and W. D. Allen, Application date 19th April, 1945.

597 251.—Shaped block of dielectric designed, when placed inside a waveguide, to produce a desired change or transformation in the mode of wave propagation.

W. D. Allen. Application date 20th June, 1945.

SIGNALLING SYSTEMS OF DISTINCTIVE TYPE

595 421.—Signalling system in which keying is effected by shifting the carrier from one fixed frequency to another, and in which both frequencies are positively or directly utilized in reception.

Marconi's W.T. Co. Ltd. (assignees of G. L. Usselman). Convention date (U.S.A.) 11th February, 1944.

595 624.—Multivibrator circuit for generating trains of pulses, and means for modulating their width in accordance with an applied signal-voltage.

Marconi's W.T. Co. Ltd. (assignees of W. A. Miller). Convention date (U.S.A.) 5th July, 1944.

595 894.—Receiving circuit for time-modulated pulsed signals in which frequency division is utilized to increase the signal-to-noise ratio.

Standard Telephones and Cables Ltd. (assignees of N. H. Young, Junr.). Convention date (U.S.A.) 6th January, 1944.

596 051.—Multi-channel signalling system utilizing pulses modulated in time to convey one message and pulses modulated in amplitude to convey other intelligence.

Standard Telephones and Cables Ltd. (assignees of D. D. Grieg). Convention date (U.S.A.) 19th May, 1944.

596 052.—Pulsed signalling-system in which a gas-filled discharge tube, having a predetermined striking-potential, serves both as generator and modulator.

Standard Telephones and Cables Ltd. (assignees of L. A. de Rosa). Convention date (U.S.A.) 17th July, 1944.

SUBSIDIARY APPARATUS AND MATERIALS

594 431.—Wave-filter network or transmission-line for wide or narrow frequency-ranges, and for use as a phase-shifter, attenuation-equalizer, and modulator.

Telephone Manufacturing Co., Ltd., and W. Saraga. Application date 29th May, 1945.

595 073.—Scanning-control for a c.r. tube, in which a full-wave rectifier produces a train of positive pulses as an intermediate step between a sinusoidal source and a saw-toothed wave.

Marconi's W.T. Co. Ltd. (assignees of E. H. Schoenfeld). Convention date (U.S.A.) 28th July, 1943.

595 200.—Stabilized harmonic generator comprising a grid-controlled discharge tube having a time-constant circuit for controlling the anode voltage.

Marconi's W.T. Co. Ltd. (assignees of G. L. Usselman). Convention date (U.S.A.) 15th May, 1943.

595 487.—Stroboscopic device for use with a cathode-ray tube for indicating or measuring and monitoring frequencies.

A. Graves, T. J. Dawes and Alltools Ltd. Application date 5th July, 1945.

ABSTRACTS AND REFERENCES

Compiled by the Radio Research Board and published by arrangement with the Department of Scientific and Industrial Research

The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to the World List practice.

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ACOUSTICS AND AUDIO FREQUENCIES

534.143 : 518.4 **1**

Magnetostriction Resonant Frequencies.—R. C. Coile. (*Electronics*, Sept. 1947, Vol. 20, No. 9, p. 130.) An abac giving the natural vibrating frequencies of an oscillator when the rod length and material are known.

534.213+534.844 **2**

Mean Free Path of Sound in an Auditorium.—A. E. Bate & M. E. Pillow. (*Proc. phys. Soc.*, 1st July 1947, Vol. 59, No. 334, pp. 535–541.) A brief review of the subject, with proofs that the mean free path of sound in an enclosure is equal to 4 × (volume/surface area) for rectangular, spherical, and cylindrical rooms of any dimensions.

534.321.9 **3**

Absorption of Supersonic Waves in Liquids.—S. B. Gurevich. (*C. R. Acad. Sci. U.R.S.S.*, 1947, Vol. 55, No. 1, pp. 17–20. In Russian.) Formulae derived by Stokes (1) and Mandelstam & Leontovich (2) are discussed and a more general formula (7) is proposed.

534.321.9 : 546.212 **4**

A Pulse Method for the Measurement of Ultrasonic Absorption in Liquids : Results for Water.—J. M. M. Pinkerton. (*Nature, Lond.*, 26th July 1947, Vol. 160, No. 4056, pp. 128–129.) Measurements were made at frequencies between 7.37 and 66.1 Mc/s using a quartz crystal as a transceiver. The pulse recurrence frequency was 250 c/s and the pulse length variable from $2\ \mu s$ to $40\ \mu s$. The values obtained for the amplitude absorption coefficient α are higher than those given by the theory of Stokes.

534.442.1 : 621.317.757 **5**

Electronic Indicator for Low Audio Frequencies.—A. E. Hastings. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1947, Vol. 35, No. 8, pp. 821–827.) For analysing a periodic complex waveform. The components within the frequency band 1 c/s to 1 kc/s are displayed on four parallel linear scales traced on a c.r. tube. Only a rough measurement of the amplitudes of the frequency components was desired, but the frequency scales can be set up, without frequency calibration and within an accuracy of 3%, from design equations developed in this paper. The performance and limitations of the instrument are described.

534.62 **6**

A New Sound-Absorbing Device of High Efficiency and the Construction of a Sound-Damped Room.—E. Meyer, G. Buchmann & A. Schoch. (*Akust. Z.*, Dec. 1940, Vol. 5, No. 6, pp. 352–364.) Measurements of the absorption by cones of various shapes led to the use of cones of 1 m overall length for the lining of a sound absorbing chamber. The cones were constructed by hand from slagwool, with a bitumen binder, and had a parallel section 15 cm long, the mouth being 15 cm × 15 cm. About 32 000 of these cones were used, fixed to the walls and roof by hooks and pins, and with points inwards, giving a clear space of 14 m × 9 m × 7 m. Results of tests carried out in the completed room are shown graphically and discussed.

534.756 **7**

Investigations on the Theory of Hearing.—H. Jung. (*Akust. Z.*, Sept. 1940, Vol. 5, No. 5, pp. 268–283.) Mathematical treatment of the propagation of sound in an elastic tube filled with a viscous incompressible fluid is used to draw conclusions as to the hydrodynamic processes which take place in the ear. The results are in agreement with the phenomena occurring in an electrical network analogous to the elastic tube and are compatible with the resonance theory of hearing.

534.756.1 **8**

Transient Reception and the Degree of Resonance of the Human Ear.—R. J. Pumphrey & T. Gold. (*Nature, Lond.*, 26th July 1947, Vol. 160, No. 4056, pp. 124–125.) Experiments have been conducted which support the Helmholtz theory of pitch discrimination based on high-Q resonators of the cochlea. Q values of 200–350 at 10 kc/s falling to about 50 at 1 kc/s were obtained.

534.851 : 621.395.66 **9**

Experimental Volume Expander and Scratch Suppressor.—McProud. (*See* 46.)

534.86 : 534.322.1 **10**

Frequency Range Preference for Speech and Music.—H. F. Olson. (*Electronics*, Aug. 1947, Vol. 20, No. 8, pp. 80–81.) Tests with live performers heard through a removable acoustic low-pass filter cutting off at 5 kc/s showed that 69% of the listeners preferred the full acoustic range, in contrast to accepted results on reproduced programmes. Reasons are suggested. See also 3007 of 1947 (Webster & McPeak) and 3765 of 1947.

534.86 : 534.322.1 **11**

Psycho-Acoustical Aspects of Listener Preference Tests.—C. J. LeBel. (*Audio Engng, N.Y.*, 1st Aug. 1947, Vol. 31, No. 7, pp. 9–12 . . 48.) A detailed and critical analysis of various attempts to discover whether listeners prefer reproduction systems to have a full or a restricted a.f. range. The economic aspects of possible improvements in the quality of reproduction are also considered. See also 3765 of 1947 (Olson) and 10 above.

534.861.1/.2 **12**

Microphone Placement for Studio Liveness.—(*Tele-Tech*, July 1947, Vol. 6, No. 7, pp. 44–45 . . 103.)

621.395.623.7 **13**

Loudspeaker Damping.—F. Langford-Smith : G. N. Patchett : P. J. Walker : C. J. Mitchell : E. J. James. (*Wireless World*, Aug. & Sept. 1947, Vol. 53, Nos. 8 & 9, pp. 309 & 343–344.) The electromagnetic damping of a loudspeaker is limited by the equivalent series impedance of the loudspeaker itself, but at resonant points the efficiency considerably exceeds its mean value, and the equivalent impedance is thus reduced.

621.395.623.8 **14**

The Distribution of Acoustic Power.—L. Chrétien. (*T.S.F. pour Tous*, July/Aug. & Sept. 1947, Vol. 23, Nos. 225/226 & 227, pp. 158–160 & 180–182.) Practical circuits for feeding a number of similar or different loudspeakers. See also 2317 and 3770 of 1947.

621.395.623.8 **15**

U.N. Broadcast and Public Address Systems.—A. W. Schneider. (*Audio Engng, N.Y.*, 1st Aug. 1947, Vol. 31, No. 7, pp. 26–29 . . 44.) A description, with illustrations and block diagrams, of the public address and broadcasting facilities in the United Nations conference room and General Assembly auditorium, New York.

621.395.625.2 **16**

On the Linear and Nonlinear Distortions of Sound Disk Apparatus.—G. Guttwein. (*Akust. Z.*, Dec. 1940, Vol. 5, No. 6, pp. 330–349.) A comprehensive experimental investigation of the dependence of distortion on recording processes, disk material and reproducing methods.

621.395.625.2 **17**

The Design of a High-Fidelity Disc Recording Equipment.—H. Davies. (*J. Instn elect. Engrs*, Part III, July 1947, Vol. 94, No. 30, pp. 275–295. Discussion, pp. 296–300.) Section 1 : Comparison of disk recording with alternative systems, and discussion of standardization of disk and groove dimensions, cutting and turntable speeds, the magnitudes of stylus amplitudes, velocities and accelerations, the use of radius compensation and the choice of the optimum recording characteristic. Section 2 : Discussion of turntable drive, design and mounting of the cutter head, methods of making cue marks and of removing swarf while recording and of obtaining radius compensation. Section 3 : Description of a high-fidelity disk recording equipment developed for the B.B.C., and of its performance.

621.395.625.2 : 621.395.667 **18**

Bass Compensation.—J. Ellis. (*Wireless World*, Sept. 1947, Vol. 53, No. 9, pp. 319–320.) For bass compensation with disk records the amplification must be inversely proportional to frequency below about 250 c/s. This is achieved by making the negative feedback proportional to the frequency.

621.395.625.3 **19**

Frequency Response of Magnetic Recording.—O. Kornei. (*Electronics*, Aug. 1947, Vol. 20, No. 8, pp. 124–128.) The effects on frequency response of the thickness of the magnetic recording medium, the depth of penetration of magnetization into the medium and the size of the recording head and gap are discussed.

621.395.625.3 **20**

Design of Magnetic Tape Recorders.—R. H. Ranger. (*Tele-Tech*, Aug. 1947, Vol. 6, No. 8, pp. 56–57 . . 100.) Discussion of German war-time development of magnetic tape recording, and American post-war improvements.

621.396.645.029.3 : 621.396.665 **21**

Automatic Gain Control and Limiting Amplifier.—Jurek & Guenther. (*See* 69.)

AERIALS AND TRANSMISSION LINES

621.392.029.64 **22**

TM$_{0.1}$ Mode in Circular Wave Guides with Two Coaxial Dielectrics.—S. Frankel. (*J. appl. Phys.*, July 1947, Vol. 18, No. 7, pp. 650–655.) "Field components for a transverse magnetic wave in a wave guide with two coaxial dielectrics are computed. A typical example is given to show the calculation of guide dimensions to reduce phase velocity to a preassigned value."

621.392.029.64 **23**

Properties of Ridge Wave Guide.—S. B. Cohn. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1947, Vol. 35, No. 8, pp. 783–788.) Equations and curves, checked experimentally, giving cut-off frequency and impedance are presented for rectangular waveguides having a rectangular ridge projecting inward from one or both wide sides. The guide has a lower cut-off frequency and impedance and greater higher-mode separation than a plain rectangular waveguide of the same width and height. A number of applications are suggested.

621.396.67 **24**

The Influence of the Width of the Gap upon the Theory of Antennas.—L. Infeld. (*Quart. appl. Math.*, July 1947, Vol. 5, No. 2, pp. 113–132.) A mathematical paper concerned with the effect of the gap across which the voltage is applied. As in the work of Stratton & Chu (1888 of 1941) the Dirac function is used to derive the driving point admittance of a spherical aerial ; a concluding section deals with the spheroidal aerial. The finite width of the gap is taken into account in both cases. The alternative approach used by the earlier workers, in which the gap width is initially allowed to tend to zero—thus resulting in an infinite driving point admittance—is critically examined.

621.396.67 **25**

Effect of Feed on Pattern of Wire Antennas.—D. C. Cleckner. (*Electronics*, Aug. 1947, Vol. 20, No. 8, pp. 103–105.) Measured polar diagrams for straight wires of lengths between $\frac{1}{2}\lambda$ and 3λ are given, showing how the feed point affects the number, orientation and magnitude of the lobes.

621.396.67 **26**

A Tentative Investigation of a Complex System of Tower Radiators for Radio Broadcasting.—B. V. Braude, I. M. Rushchuk & M. M. Pruzhanski. (*Radiotekhnika, Moscow*, July/Aug. 1947, Vol. 2, No. 6, pp. 22–33. In Russian.) In designing a radiating system having four self-supporting towers at the corners of a square, and intended for both directional and non-directional broadcasting, experiments were conducted with a model using brass lattice towers 250 cm high, erected on a ground system of galvanized iron sheets. The radiators were fed through single conductor feeders from two u.s.w. oscillators covering a wavelength range from 3 to 9 m. Measurements were made of the input impedance of the radiators, of the phase velocity of e.m. waves along them, and of the directivity coefficient of the system for various operating conditions. Experimental curves so obtained are shown and the conclusions reached regarding the operation of the proposed system are enumerated.

621.396.67 : 517.512.2 **27**

Fourier Transforms in Aerial Theory : Part 3 — Operations with Fourier Transforms.—Ramsay. (*See* 155.)

621.396.67 : 621.396.621 **28**

Is a Big Aerial Worth While ?—M. G. Scroggie. (*Wireless World*, Sept. 1947, Vol. 53, No. 9, pp. 314–318.) Discussion showing the many advantages of a good outdoor aerial.

621.396.67 : 621.397.5 **29**

Television Aerials.—F. R. W. Strafford & J. N. Pateman. (*Wireless World*, Sept. 1947, Vol. 53, No. 9, p. 344.) Comment on 3799 of 1947 (Best & Beebe).

621.396.67 : 621.397.5 **30**

Performance Characteristics of the WABD TV Antenna System.—G. E. Hamilton. (*Communications*, July 1947, Vol. 27, No. 7, pp. 16–18 . . 43.) The advantages of the 3-bay superturnstile batwing aerial system used are discussed. The performance specifications are listed and compared with actual results. An earlier article on the installation and testing of this system was noted in 3432 of 1947 (Deneke).

621.396.67.029.64 **31**

Radiators for Centimeter Waves.—(*Tele-Tech*, July 1947, Vol 6, No. 7, pp. 55–56.) Summary of 1622 of 1947 (Gutton). U.D.C. of 1622 should read as above.

621.396.67.029.64 : 621.317.79 **32**

Microwave Antenna Beam Evaluator.—H. Le-Caine & M. Katchky. (*Electronics*, Aug. 1947, Vol. 20, No. 8, pp. 116–120.) Apparatus for automatic tracing of polar diagrams of microwave aerials to an accuracy within 1%. Square law detectors are used at the transmitter, whose aerial is rotated, and at the fixed receiver. A self-balancing system using motor-driven ganged potentiometers gives the traced diagram a linear scale and eliminates errors due to varying transmitting power and external interference.

621.396.674 **33**

Calculation of the Current for Frame Receiving Aerials.—J. Müller-Strobel & J. Patry. (*Schweiz. Arch. angew. Wiss. Tech.*, July 1947, Vol. 13, No. 7, pp. 193–202.) An approximate solution for circular frame aerials of N turns is based on the theory of Hallén, assuming that the wire radius is small compared with the coil radius and that the coil radius is small compared with the wavelength of the incoming radio waves.

621.396.674 **34**

Note on Circular Loop Antennas with Non-Uniform Current Distribution.—G. Glinski. (*J. appl. Phys.*, July 1947, Vol. 18, No. 7, pp. 638–644.) The radiation patterns, power gain, and radiation resistance are calculated for a closed loop of perimeter $\leqslant \frac{1}{2}\lambda$ with a hyperbolic-cosine current distribution. The effective attenuation constant of the equivalent transmission line is deduced from the radiated power. The theory agrees closely with experiment.

621.396.69 **35**

Antenna Tower Design.—R. G. Peters. (*Communications*, July 1947, Vol. 27, No. 7, pp. 28–29.)

CIRCUITS AND CIRCUIT ELEMENTS

518.5 **36**

Electronic Computing Circuits of the ENIAC.—Burks. (*See* 158.)

518.5 : 621.318 **37**

Use of Magnetic Amplifiers in Computing Circuits.—Beyer. (*See* 159.)

621.314.23 : 621.396.69 **38**

Practical Transformer Design and Construction : Parts 2 & 3.—C. Roeschke. (*Radio News*, July & Aug. 1947, Vol. 38, Nos. 1 & 2, pp. 58–59 . . 137 & 60 . . 124.) The design of filter chokes, anode modulation transformers, and audio output transformers. Part 1 : 3038 of 1947.

621.316.722.1 : 621.385.38 **39**

Shunt Tube Control for Thyratron Rectifiers.—J. A. Potter. (*Bell Lab. Rec.*, July 1947, Vol. 25, No. 7, pp. 273–276.) The inherent delay of thyratron rectifiers in eliminating brief, steep-fronted voltage variations by changes of grid bias is overcome by connecting the anode circuit of a valve across the load. The grid bias of this valve is controlled by a regulating circuit so that small current changes pass through the valve without flowing through the thyratron, which reacts only to the average load.

621.316.8 : 621.317.33 **40**

Method for determining the Time Constant of Resistors at Low Frequency.—Ney. (*See* 166.)

621.318.323.2 : 538.213 **41**

Auxiliary Magnetisation.—(*Elect. Times*, 21st Aug. 1947, Vol. 112, No. 2911, pp. 211–212.) Summary of article in the June/July 1947 issue of *Brown Boveri Rev.* Methods are given for calculating the effective permeability of current transformer cores using a.c. auxiliary magnetization.

621.319.4 **42**

Significance of Watt-Second Ratings of D.C. Capacitors.—J. D. Stacy. (*Communications*, Aug. 1947, Vol. 27, No. 8, pp. 24–25 . . 41.) When the life and the high-temperature performance of capacitors are to be considered, watt-second rating gives a better criterion than voltage and capacitance rating.

621.392 : 003.62 **43**

Shorthand Circuit Symbols.—B.G. (*QST*, Aug. 1947, Vol. 31, No. 8, pp. 46–47.) Comment on 2030 of 1947 (Keen).

621.392 : 518.5 **44**

Machine Computing of Networks.—Dunstan. (*See* 160.)

621.392.1 **45**

Transformers — Obvious and Otherwise.—"Cathode Ray". (*Wireless World*, Oct. 1947, Vol. 53, No. 10, pp. 388–390.) An elementary explanation of the way in which various tuned and untuned coupling networks do in fact act as transformers, as was stated in the article abstracted in 2919 of 1947 (Moxon).

621.395.66 : 534.851 **46**

Experimental Volume Expander and Scratch Suppressor.—C. G. McProud. (*Audio Engng, N.Y.*, 1st Aug. 1947, Vol. 31, No. 7, pp. 13–15 . . 41.) A number of familiar circuits are combined into one unit. Block and circuit diagrams are given and component values stated. The unit is preceded by a 2-stage preamplifier.

621.396.611.3 **47**

Variation of an RC Parallel-T Null Network.—H. S. McGaughan. (*Tele-Tech*, Aug. 1947, Vol. 6, No. 8, pp. 48–51 . . 95.) "When used in the negative feedback loop of an amplifier, this network produces either a frequency-selective amplifier or an oscillator, depending on the choice of circuit parameters. An unsymmetrical null network is shown which provides greater selectivity than is possible with the conventional network under the same conditions of amplification." See also 1464 of 1946 (Hastings).

621.396.611.4 : 518.4 **48**

Charts for Resonant Frequencies of Cavities.—R. N. Bracewell. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1947, Vol. 35, No. 8, pp. 830–841.) Six abacs are given which may be used for designing cylindrical resonant cavities whose cross-sections are circles, concentric circles, squares, or rectangles. The equations involved, the method of use, and the special advantages of each abac are described, together with the method of construction. The effects of small deformations or of wavelength changes are considered.

621.396.615 **49**

RC Oscillator Control.—B. J. Solley. (*Wireless World*, Sept. 1947, Vol. 53, No. 9, pp. 321–322.) A network is described, by which the frequency of a RC oscillator may be adjusted over a wide range, using a single potentiometer control. A frequency range of 4 : 1 may be obtained with only 1 db variation in amplitude, and a range of 25 : 1 if greater amplitude variation is permissible.

621.396.615.029.3 **50**

A Wide Range Audio Oscillator.—F. W. Dawe. (*Electronic Engng*, Aug. 1947, Vol. 19, No. 234, pp. 246–248.) An RC amplifier back-coupled through a frequency discriminating network of the Wien bridge type. Frequency range is 20–20 000 c/s, covered in three bands.

621.396.615.029.5/.63 **51**

Wide-Range Sweeping Oscillator.—Engineering Staff, Kay Electric Co. (*Electronics*, Aug. 1947, Vol. 20, No. 8, pp. 112–115.) A 50-kc/s to 500-Mc/s beat-frequency oscillator with sawtooth frequency modulation variable up to 40 Mc/s. Two 3-cm klystron oscillators are used, one being varied in frequency by a panel control of cavity resonator shape and modulated in frequency by variation of the repeller electrode potential. The two klystron frequencies are measured by a precision absorption wavemeter, the difference giving the beat frequency.

621.396.615.14 **52**

U.S.W. Oscillators.—E. P. Korchagina. (*Radiotekhnika, Moscow*, July/Aug. 1947, Vol. 2, No. 6, pp. 34–43. In Russian.) The effects of interelectrode capacitances and of the inductance of the leads on the operation of the oscillators are investigated theoretically. Suitable oscillating circuits are discussed and design methods indicated.

621.396.615.14 **53**

High Power U.S.W. Valve Oscillators.—A. M. Kugushev & D. I. Karpovski. (*Radiotekhnika, Moscow*, July/Aug. 1947, Vol. 2, No. 6, pp. 48–54. In Russian.) The use of transmission lines with distributed constants as tuning elements for high power demountable valves is considered and experiments are described with such valves operating on wavelengths from 2 to 3.5 m and with outputs from 8 to 60 kW.

54

621.396.615.142.2 : 621.392.029.64 : 621.396.619.11

Ultra High Frequency Modulation on Wave-Guides.—H. Gutton & J. A. Ortusi. (*J. Brit. Instn Radio Engrs*, Oct. 1947, Vol. 7, No. 6, pp. 205–210. Discussion, pp. 210–211.) A description of a method of modulating a master klystron oscillator combined with a v.m. amplifier tube. The energy produced is fed to the radiator by a waveguide across which is connected a magnetron working in a cut-off condition and such that variations of anode voltage vary its impedance. By means of a transformer between the magnetron and the guide the impedance across the guide can be made to vary from zero to infinity, thus enabling 100% modulation to be obtained.

Application to a 100-W television transmitter for a wavelength of 21.5 cm and up to 20 Mc/s modulation frequency is briefly described.

For a fuller account see *Onde élect.*, Aug./Sept. 1947, Vol. 27, Nos. 245/246, pp. 307–312.

621.396.615.18 **55**

Cathode-Coupled Half-Shot Multivibrator.—R. K. F. Scal. (*Electronics*, Sept. 1947, Vol. 20, No. 9, pp. 150..158.) Describes a double-triode common-cathode RC trigger circuit with two stable states operated alternately by successive negative pulses applied across the cathode bias resistor; the output from either anode therefore occurs at half the repetition frequency of the initiating pulses, and is square-wave in form. Successive frequency division may be obtained by connecting units in tandem with differentiating RC coupling circuits.

621.396.619.23 + 621.396.645 **56**

A 120-Watt Modulator and Speech Amplifier.—C. V. Chambers. (*QST*, Aug. 1947, Vol. 31, No. 8, pp. 13–18.) A compact 3-stage amplifier-modulator using Type 807 valves in class AB2 and having a restricted a.f. response. Full circuit and construction details are given.

621.396.621 + 621.396.69 **57**

British Printed and Sprayed Circuits.—(*See* 238.)

621.396.621 **58**

Theory and Practice of Cathodyne Dephasing.—S. Bertrand. (*T.S.F. pour Tous*, July/Aug. 1947, Vol. 23, Nos. 225/226, pp. 166–169.) A qualitative and quantitative treatment, with experimental verification of the theory.

621.396.622.71 **59**

Ratio Detector for F.M. Signals.—(*See* 248.)

621.396.645 **60**

Amplifier with Variable Bandwidth.—F. Juster. (*Toute la Radio*, Sept. 1947, Vol. 14, No. 118, pp. 258–260.) A design giving (*a*) very large bandwidth with low sensitivity, (*b*) medium bandwidth with medium sensitivity, or (*c*) small bandwidth with high sensitivity. The changes are effected by varying the anode resistance of each valve.

621.396.645 **61**

Harmonic-Amplifier Design.—R. H. Brown. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1947, Vol. 35, No. 8, pp. 771–777.) Two methods are presented for calculating the ideal performance of harmonic-amplifier stages as used in frequency multiplication. The first gives approximate results while the second, a graphical method, is exact. Performance may be adversely affected by degenerative effects introduced by the grid-anode capacitance and by inductance in the cathode circuit common to both grid and anode circuits. Circuit arrangements for overcoming these degenerative effects are discussed theoretically and applications are indicated.

621.396.645 : 518.3 **62**

Square Wave Response.—A. J. Baracket. (*Electronics*, Aug. 1947, Vol. 20, No. 8, p. 130.) Abac giving the degree of tilting of a square wave by an RC coupling circuit.

621.396.645 : 518.4 **63**

Gain Chart for Cathode Followers.—G. Houck. (*Tele-Tech*, Aug. 1947, Vol. 6, No. 8, pp. 54–55.)

621.396.645 : 621.317.755 **64**

Wide Band Oscilloscope Amplifier.—C. E. Hallmark & R. D. Brooks. (*Tele-Tech*, Aug. 1947, Vol. 6, No. 8, pp. 38–39.) " Balanced push-pull direct-coupled stages provide characteristics necessary for square wave analysis and television applications." Net bandwidth is 15 Mc/s.

621.396.645 : 621.317.755 **65**

Direct-Coupled Oscillograph Amplifier.—D. R. Christian. (*Elect. Engng, N.Y.*, Sept. 1947, Vol. 66, No. 9, p. 927.) Summary of A.I.E.E. Dayton paper. A stabilized amplifier for use with magnetic-pen motor recorder. General requirements, circuit details and applications are discussed.

621.396.645 : 621.385.029.63/.64 **66**

On Two Designs for V.H.F. Electronic Amplifiers with Travelling-Wave Valves.—J. P. Voge. (*C. R. Acad. Sci., Paris*, 23rd Dec. 1946, Vol. 223, No. 26, pp. 1117–1119.) Ramo has considered small oscillations of the form $F(r)e^{j(\omega t - \gamma z + n\theta)}$, with symmetry of order n about the axis of a cylindrical electron beam (4352 of 1939). A formula is here deduced for the power flow through a section of the beam when it is surrounded by an infinitely long cylindrical metal sheath and there is an intense axial field. This formula shows the existence of successive bunchings and debunchings, and a theoretically infinite amplification for a certain length. The energy, being kinetic, should be picked up inductively.

Formulae are also derived for the case where the beam is surrounded by a matched, lossless transmission line, with which the beam has a continuous exchange of energy. The gain is found to be independent of ω and proportional to the square root of the charge per unit length.

621.396.645.029.3 **67**

Multi-Purpose Audio Amplifier.—M. P. Johnson. (*Audio Engng, N.Y.*, 1st Aug. 1947, Vol. 31, No. 7, pp. 20–23..39.) " Combines high gain, unusually high fidelity, and an expander-compressor circuit. It can be easily built from readily obtainable components." Full circuit and constructional details are given.

621.396.645.029.3 : 621.396.61 **68**

Level-Governing Audio Amplifier.—(*Tele-Tech*, Aug. 1947, Vol. 6, No. 8, pp. 67–69..96.) Design of a programme-operated amplifier which will automatically minimize overmodulation of the radio transmitter. A control circuit reduces amplifier gain when the input exceeds a predetermined value. See also 1189 of 1942 (Black & Norman).

621.396.645.029.3 : 621.396.665 **69**

Automatic Gain Control and Limiting Amplifier.—W. M. Jurek & J. H. Guenther. (*Electronics*, Sept. 1947, Vol. 20, No. 9, pp. 94–97.) Describes in detail an audio programme amplifier, installed between the studio audio apparatus and the transmitter, for maintaining a high peak modulation depth without danger of overloading and with minimum reduction of dynamic range. For another account see *Communications*, Aug. 1947, Vol. 27, No. 8, pp. 18..37.

621.396.645.029.62 **70**
Four-Tetrode F.M. Power Amplifier.—(*Electronics*, Aug. 1947, Vol. 20, No. 8, pp. 132, 134.) A 10-kW amplifier having four tetrodes arranged in a square. Four rods leading vertically from the anodes to a shorting plate form a 4-wire λ/4 line with adjacent wires fed in antiphase. This system gives a small external field. The aerial coupling system is described.

621.396.662.2.076.2 : 621.396.621 **71**
Permeability Tuning of Broadcast Receivers.—L. O. Vladimir. (*Electronics*, Aug. 1947, Vol. 20, No. 8, pp. 94–99.) An analysis of the series-loop and transformer-coupled loop aerial circuits and a comparison with the capacitance-tuned high impedance circuit. Coil winding data for obtaining the correct pitch for oscillator tracking are given.

621.396.662.212.029.58 : 621.315.212 **72**
A Plug-In Type Resonant Line Tank Coil.—H. C. Sherrod. (*CQ*, June 1947, Vol. 3, No. 6, pp. 19–21.) For use at 28 Mc/s in a high-level a.m. R/T transmitter. A λ/4 resonant line is used to increase the output tank circuit efficiency.

621.396.662.3 + 621.314.6 **73**
Analysis of Full-Wave Rectifier and Capacitive-Input Filter.—D. L. Waidelich. (*Electronics*, Sept. 1947, Vol. 20, No. 9, pp. 120–123.) The effects of finite filter inductance were determined by means of the author's steady-state operational calculus (1276 of 1946). Data concerning flow angles, output voltage, ripple and peak valve currents enable the circuit to be designed for any load and frequency.

621.396.621.004.67 **74**
Most-Often-Needed 1947 Radio Diagrams and Servicing Information. [Book Review]—Beitman. (*See* 256.)

GENERAL PHYSICS

53.081 **75**
Magnetic Units.—"Cathode Ray". (*Wireless World*, Sept. 1947, Vol. 53, No. 9, pp. 339–342.) The c.g.s. and the m.k.s. systems are discussed and the great advantages of the latter emphasized. See also 1392 and 2383 of 1947 (Dorgelo & Schouten).

530.145.6 **76**
On the Frequency and Phase Velocity of Monochromatic Plane Waves in Wave Mechanics.—L. de Broglie. (*C. R. Acad. Sci., Paris*, 25th Aug. 1947, Vol. 225, No. 8, pp. 361–363.) In wave mechanics a plane monochromatic wave Ψ is characterized by the four quantities: frequency ν, wavelength λ, phase velocity V and group velocity U, of which only λ and U are directly measurable. Some authors have concluded that, for Ψ waves, ν and V are at least partially indeterminate. It is here shown that this is not the case and formulae are derived which give directly the values of ν and V corresponding to a value of λ. From these formulae the classical expressions for ν and V are deduced.

531.53 : 519.24 **77**
Fluctuations in Quasi-Sinusoidal Physical Quantities.—A. Blanc-Lapierre & P. Lapostolle. (*J. Phys. Radium*, June 1946, Vol. 7, No. 6, pp. 153–164. Reprint.) A study of various mechanisms from the statistical point of view, taking account of amplitude and phase stability and particularly of the spectral distribution of energy. The mechanisms considered are: (*a*) pendulum with little damping excited by external shocks evenly distributed, nearly evenly distributed or completely irregular; (*b*) pendulum with little damping, self-maintained by shocks whose amplitude and time of application fluctuate about the normal values (i.e., equal shocks when the pendulum passes the equilibrium position); (*c*) alternator with slight speed fluctuations.

537.212 : 621.392.029.64 **78**
The Electrostatic Field of a Point Charge inside a Cylinder, in connection with Wave Guide Theory.—C. J. Bouwkamp & N. G. de Bruijn. (*J. appl. Phys.*, June 1947, Vol. 18, No. 6, pp. 562–577.) A theoretical paper in which the case of an axial point charge is considered in detail. Three methods of approach are used; from the point of view of wave propagation inside the cylinder, stress is laid on the third method in which the potential is developed in terms of discrete normal solutions of the potential equation. This enables the distant fields to be calculated from the behaviour close to the exciting source; as an illustration the theory is applied to the propagation of sound waves from a vibrating point source.

537.226.2 : [546.212 + 546.212.02 **79**
On the Dielectric Properties of Ordinary Water, Heavy Water and of Ionic Solutions at High Frequencies.—D. M. Ritson, J. B. Hasted & C. H. Collie. (*C. R. Acad. Sci., Paris*, 4th Aug. 1947, Vol. 225, No. 5, pp. 285–287.) Measurements of the real and imaginary parts of the dielectric constant were made for water between 0°C and 75°C and for heavy water between 5°C and 40°C, at wavelengths of 10, 3 and 1.25 cm. Application of Debye's equations gives values within 1% of the optical constants. The critical wavelength decreases with rise of temperature and is in agreement with Onsager's theory. Results for various solutions are discussed.

537.228.1 **80**
Deflection of a Piezoelectric Rod.—A. A. Kharkevich. (*Zh. tekh. Fiz.*, 1943, Vol. 13, Nos. 7/8, pp. 423–430. In Russian.) The vibration of a rod consisting of two parallel layers of Rochelle salt is investigated mathematically for different operating conditions.

537.291 + 538.691 **81**
The Principles of a General Theory of the Focusing Action of Static Electric and Magnetic Fields.—G. A. Grünberg. (*Zh. tekh. Fiz.*, 1943, Vol. 13, Nos. 7/8, pp. 361–388. In Russian.) A general method is proposed for determining the fields necessary for obtaining an electron or ion beam of a given form. The number of possible trajectories of particles in a beam is established for different types of field. Particular attention is paid to the focusing of narrow beams.

537.291 **82**
Electron Reflectors with a Quadratic Axial Potential Distribution.—J. M. Lafferty. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1947, Vol. 35, No. 8, pp. 778–783.) A theoretical paper. The electrons are injected into a retarding field through a central

aperture in one of the two electrodes between which the field is established. The permissible angle of divergence or convergence which an incident electron may have and yet be focused back through the aperture is examined. The transit time for axial electrons is computed. Possible electrode shapes to set up the desired field distribution are discussed.

537.311.2 **83**
Ohm's Law.—T. Carter. (*Elect. Rev., Lond.*, 1st Aug. 1947, Vol 141, No. 3636, pp. 167–168.) A discussion based on Ohm's original treatise, " The Galvanic Circuit, Mathematically Treated ". See also 1063 and 2393 of 1947.

537.311.3 **84**
Electronic Conductivity of Non-Metallic Materials.—E. J. W. Verwey. (*Philips tech. Rev.*, 1947, Vol. 9, No. 2, pp. 46–53.) The simultaneous occurrence of electronic conductivity, photoelectrical phenomena, light absorption and deviation from stoichiometric composition in certain semiconducting materials indicates possible causes of these phenomena.

537.311.3 : 536.48 **85**
Measurement of the Resistance of PbS near Absolute Zero.—Yu. A. Dunaev. (*C. R. Acad. Sci. U.R.S.S.*, 1947, Vol. 55, No. 1, pp. 21–23. In Russian.) The conclusions of an experimental investigation are :—(*a*) PbS is not a semiconductor in the usual sense of the word ; (*b*) the hole and electron types of PbS behave identically at low temperatures ; (*c*) no superconductivity effects have been observed.

537.311.33 : 621.314.634 **86**
Effect of Bending on Selenium Rectifier Disks.—P. Selényi & N. Székely. (*Nature, Lond.*, 9th Aug. 1947, Vol. 160, No. 4058, p. 197.) Bending a Se rectifier disk causes a temporary increase of the current flowing through it in both directions. The effect is greatest for the reverse current ; it is explained by dissociation of the impurity centres, combined with plastic relaxation effects.

537.311.33 : 621.396.622.6 **87**
Application of the Theory of Conduction in Semiconductors to Crystal Detectors.—M. Leblanc. (*Bull. Soc. franç. Élect.*, Aug. 1947, Vol. 7, No. 72, pp. 445–452.) The modifications of the structure of the crystal lattice brought about by the presence of small quantities of impurities can explain the rectification properties of certain semiconductors. The latent image in photography, the properties of oxide cathodes, and probably the phenomena of fluorescence, may be explained similarly. See also 1468 of 1947.

537.533 : 539.23 **88**
An Investigation of Auto-Electron Emission from Thin Dielectric Films.—D. V. Zernov, M. I. Elinson & N. M. Levin. (*Bull. Acad. Sci. U.R.S.S., Classe Sci. tech.*, 1944, No. 3, pp. 166–181. In Russian.)

537.533.8 **89**
Present State of Knowledge of Secondary Electron Emission from Solids.—P. Palluel. (*Ann. Radioélect.*, July 1947, Vol. 2, No. 9, pp. 199–223.) The important part played by secondary emission effects in valves is briefly reviewed and a detailed discussion is given of the principal laws, and of the composition and fundamental mechanism of the secondary radiation. The emissive properties of the alkaline earth and alkali metals, metallic compounds, complex layers, oxide cathodes and alloys of high output are examined in detail, numerous curves being given.

538.569.4.029.64 : 546.171.1 **90**
The Hyperfine Structure of the Ammonia Inversion Spectrum in an Electric Field.—J. M. Jauch. (*Phys. Rev.*, 15th Sept. 1947, Vol. 72, No. 6, p. 535.) Summary of Amer. Phys. Soc. paper.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.53 : 551.510.535 **91**
Evaporation of Meteors.—T. L. Eckersley. (*Nature, Lond.*, 19th July 1947, Vol. 160, No. 4055, p. 91.) Discussion of certain radar photographs in *Nature* and *The Times*. It is suggested that scatter clouds can be produced by the evaporation of small meteors, and that meteors below a certain size will evaporate. The photographs probably show scatter clouds rather than meteors large enough to be visible. There is a close analogy between the scattering of radio waves from scatter clouds and that of α-particles from heavy molecules, leading to the Rutherford fourth power law. It is the small clouds, the invisible evaporating meteors, which scatter effectively.

523.53 : 551.510.535 **92**
Radio Reflexions from Meteoric Ionization.—J. S. Hey. (*Nature, Lond.*, 19th July 1947, Vol. 160, No. 4055, pp. 74–76.) Notes on a discussion at a Physical Society meeting on 31st Jan. 1947 of recent researches by radio and radar methods into ionospheric ionization by meteors. See also 93 below.

523.53 : 551.510.535 **93**
Meteors, Comets and Meteoric Ionization.—A. C. B. Lovell. (*Nature, Lond.*, 19th July 1947, Vol. 160, No. 4055, pp. 76–78.) Notes on a conference held at Manchester University under the auspices of the Physical Society. See also 92 above.

523.7 **94**
The Sun a Regular Variable Star.—C. G. Abbot. (*Science*, 20th June 1947, Vol. 105, No. 2738, p. 632.) Summary of National Academy of Sciences paper. The solar constant of radiation for the years 1924–44 has a regular periodicity of 6.645 6 days. Statistical studies show fluctuations of temperature of identical average period and average range 5°F.

523.72 + 523.854] : 621.396.822 **95**
Emission of Radio-Waves by the Galaxy and the Sun.—J. S. Shklovsky. (*Nature, Lond.*, 31st May 1947, Vol. 159, No. 4048, pp. 752–753.) Henyey's and Keenan's theory of long-wave radio emission (*Astrophys. J* , 1940, Vol. 91, pp. 625 ff.) is extended to take account of the absorption due to free electrons. In order to correlate the theory with observations on the emission from the sun, it is necessary to assume that the electron temperature of the outer corona is about 3 500°.

The occasional intense solar emission in the range 7–30 m may be due to excitation of the corona plasma by the flow of charged corpuscles through the corona with a velocity greater than that of sound. This would give a magnetic storm about one day after the anomalous radio emission.

523.72 : 621.396.822.029.62 **96**

Relation between the Intensity of Solar Radiation on 175 Mc/s and 80 Mc/s.—M. Ryle & D. D. Vonberg. (*Nature, Lond.*, 2nd Aug. 1947, Vol. 160, No. 4057, pp. 157–159.) Simultaneous observations at the two frequencies were made between Dec. 1946 and April 1947 by the technique described in 89 of 1947. Short-lived bursts having an intensity up to five times the mean value and lasting from 1 to 20 sec occur at both frequencies but at uncorrelated times; bursts having intensities 20 to 100 times the mean value can persist for many minutes and are usually observed on both frequencies. The day-to-day variation of intensity on the two frequencies is also investigated. See also 3508 of 1947 (Appleton & Hey).

523.74 **97**

A Short-Lived Solar Phenomenon in High Latitude.—A. D. Thackeray. (*Nature, Lond.*, 27th Sept. 1947, Vol. 160, No. 4065, pp. 439–440.) An intensely dark absorption flocculus was observed in the region with heliographic coordinates 6°W, 61°S from 09 h. 46 m. GMT onwards on 19th June 1947. It appears to be similar to the dark flocculi in regions surrounding sunspots and flares, and there is evidence that it was associated with increased radio noise on 175 Mc/s.

523.745 **98**

Information on Solar Activity by Radio.—(*Nature, Lond.*, 30th Aug. 1947, Vol. 160, No. 4061, p. 293.) The daily sunspot (relative) numbers given by the Swiss Federal Observatory, Zurich, are broadcast monthly in the short-wave service of the Swiss Broadcasting Corporation. Dates, times, wavelengths and languages of the transmissions are detailed.

523.746.5 **99**

On the Forecasting of Sunspots.—M. Mayot. (*C. R. Acad. Sci., Paris*, 16th June 1947, Vol. 224, No. 24, pp. 1699–1701.) A method making use of 1884–1946 data to derive formulae giving the probable Wolf-Wolfer numbers for each month for one and for two years in advance. The numbers for 1948 approximate to those of Gleissberg (1830 of 1946 and back references) and of Waldmeier (2560 of 1946).

523.854 : 538.12] : 537.591 **100**

On the Magnetic Field of the Milky Way and Its Effect on Cosmic Radiation.—M. S. Vallarta. (*Phys. Rev.*, 15th Sept. 1947, Vol. 72, No. 6, p. 519.) Comment on 3891 of 1947 (Babcock). "So long as the condition of weak magnetic coupling among the stars of a galaxy still obtains, stellar dipole moments are still oriented at random and the resultant field of the galaxy almost vanishes."

537.591 **101**

On the Production Process of Mesons.—V. F. Weisskopf. (*Phys. Rev.*, 15th Sept. 1947, Vol. 72, No. 6, p. 510.)

537.591 : 523.75 **102**

Solar Effects in Cosmic Rays.—S. E. Forbush. (*Science*, 20th June 1947, Vol. 105, No. 2738, p. 634.) Summary of National Academy of Sciences paper. Magnetograms from several magnetic observatories indicate that three sudden increases in cosmic ray intensity during the past 10 years cannot be ascribed to changes in the earth's magnetic field. Arguments are propounded suggesting that changing magnetic fields associated with a sunspot or solar flare may act as magnetic accelerators for charged particles.

538.712 **103**

Forecasting the Diurnal Variation of the Magnetic Declination.—J. Coulomb. (*C. R. Acad. Sci., Paris*, 16th June 1947, Vol. 224, No. 24, pp. 1727–1728.) A method making use of past records and the Wolf-Wolfer numbers to derive a simple formula.

550.38 **104**

Frenkel's Views on the Origin of Terrestrial Magnetism.—L. B. Slichter & E. C. Bullard. (*Nature, Lond.*, 2nd Aug. 1947, Vol. 160, No. 4057, p. 157.) Comment on 2896 of 1946. A paper entitled "Magnetic Field of Sunspots", by T. G. Cowling (*Mon. Not. R. astr. Soc.*, Nov. 1933, pp. 39–48) contains a theorem which appears to invalidate Frenkel's theory.

551.510.535 **105**

On the Sporadic F_2 Layer of the Ionosphere.—Ya. L. Al'pert. (*C. R. Acad. Sci. U.R.S.S.*, 1947, Vol. 55, No. 1, pp. 25–26. In Russian.) As a result of recent ionosphere investigations it is suggested that the three- and four-tailed characteristics of ionosphere reflection records (Figs. 1 and 2) are due to double refraction of the ray taking place in the main F_2 layer and in semi-transparent sporadic ionized clouds appearing in this layer.

551.510.535 : 525.624 **106**

Atmospheric Tides in the Ionosphere : Part 2 — Lunar Tidal Variations in the F Region near the Magnetic Equator.—D. F. Martyn. (*Proc. roy. Soc. A*, 8th July 1947, Vol. 190, No. 1021, pp. 273–288.) Examination of the data for the heights and critical frequencies of the F regions over three years at Huancayo, Peru, shows the existence of semidiurnal tides in all quantities except $f^0_{F_1}$. The lunar variation in the F_2 region depends on solar time in both phase and amplitude and at certain epochs attains very large amplitudes, up to 60 km for $h^{\max}_{F_2}$ and 28% for $f^0_{F_2}$.

The theory of these variations given in part 1 of this paper (2421 of 1947) is extended.

551.510.535 : 621.396.11 **107**

The Ionosphere.—J. H. Dellinger. (*Sci. Mon., N.Y.*, Aug. 1947, Vol. 65, No. 2, pp. 115–126.) A general survey of ionosphere characteristics such as layer height, ionization density, energy absorption, and radio noise, and their significance. World-wide observations have extended knowledge of these phenomena, thus allowing reliable predictions to be made of radio propagation conditions.

551.510.535 : 621.396.11 **108**

A Frequency Prediction Service for Southern Africa.—Hewitt, Hewitt & Wadley. (*See* 229.)

551.524.4 **109**

The Daily Course of Temperature in the Troposphere.—E. S. Seleznyova. (*Bull. Acad. Sci. U.R.S.S., sér. géogr. géophys.*, 1945, Vol. 9, No. 2, pp. 82–88. In Russian with English summary.) The daily oscillations of temperature in the lower layers of the troposphere appear to be influenced by the earth's surface, and their amplitude decreases with increasing height. In the middle and upper troposphere an independent diurnal variation occurs, determined by physical properties of the atmosphere.

551.594.221 **110**
Lightning Research in Switzerland.—K. Berger. (*Weather, Lond.*, Aug. 1947, Vol. 2, No. 8, pp. 231–238.) A description of the technique and equipment employed at Monte San Salvatore, together with an analysis of the 25 oscillograms of lightning strokes obtained during the period 1943–1946. See also 2269 of 1939 (McEachron).

LOCATION AND AIDS TO NAVIGATION

621.396(99) **111**
Electronics in the Antarctic.—Bailey. (*See* 259.)

621.396.932 **112**
International Recommendations for Marine Electronic Aids.—(*Electronics*, July & Aug. 1947, Vol. 20, Nos. 8 & 9, pp. 144..244 & 144, 146.) Abstract of the report of the 1947 International Meeting on Marine Radio Aids to Navigation. Performance standards are laid down for radio equipment and radar for position-fixing within range of suitable fixed targets, either natural or artificial. Compulsory fitting of radar and frequency standardization are not yet contemplated. Development of a reliable overall performance monitor and of devices for better identification of shore features and small ships is recommended. Medium frequency d.f. services, though not fully satisfying standard requirements, should be continued. Decca services should be expanded, and for long range, standard loran should be adopted. Medium range aids should have priority over long range, but marine requirements should be considered when setting up long range aircraft aids. For short range communication, 2-way 150-Mc/s R/T is recommended. Main components of equipment should be standardized.

621.396.933 **113**
Radio Navigational Aids.—W. J. O'Brien. (*J. Brit. Instn Radio Engrs*, Oct. 1947, Vol. 7, No. 6, pp. 215–246. Discussion, pp. 247–248.) A general discussion, with particular reference to the Decca system.

621.396.933 : 621.396.96 **114**
Radar System for Airport Traffic and Navigation Control : Part 1.—F. J. Kitty. (*Tele-Tech*, Aug. 1947, Vol. 6, No. 8, pp. 40–44..104.) Description of a fixed ground radar system, based on the war-time Navy G.C.A., for airport surveillance, height finding, traffic control and instrument approach under all conditions of visibility. The height-finder, azimuth and elevation systems operate at frequencies near 9 000 Mc/s, and the search system at 2 900 Mc/s. Two-way communication with aircraft is provided in the 2–9 Mc/s and 100–156 Mc/s bands.

621.396.933 : 621.396.96 **115**
Airborne Radar.—(*S.A.E. J.*, Aug. 1947, Vol. 55, No. 8, pp. 27–31.) Based on a paper entitled "American Airlines' Evaluation of Airborne Radar", read before the S.A.E. Mid-Continent Section. The APS-10 radar, with the aerial modified to give a pencil beam, provides a simple and effective method of collision prevention under blind-flying conditions. A number of photographs are given of actual p.p.i. displays obtained during flight tests.

621.396.96 : 621.318.572 **116**
Video Switching and Distribution System.—R. D. Chipp. (*Tele-Tech*, July 1947, Vol. 6, No. 7, pp. 50–54..111.) Naval equipment for plan position indications to remote repeaters.

621.396.96 : 621.396.619.23 : 778 **117**
Photographing Pulse Wave Shapes of Radar Modulators.—Marks. (*See* 288.)

621.396.96 **118**
Radar Engineering. [Book Review]—D. G. Fink. McGraw-Hill, London, 644 pp., 35s. (*Wireless World*, Sept. 1947, Vol. 53, No. 9, p. 345.) "A presentation of the underlying principles and commonly-used techniques, illustrated by some typical examples."

MATERIALS AND SUBSIDIARY TECHNIQUES

533.5 : 621.3.032.53 **119**
The Effect of Heat Treatment in Different Atmospheres on the Stress in Tungsten-to-Glass Seals.—M. Manners. (*J. Soc. Glass Tech.*, Aug./Oct. 1946, Vol. 30, No. 139, pp. 217–238.) A study of the relations between the heating time and temperature, in air or in hydrogen, and the longitudinal stress at the glass-metal boundary of single-wire 'oxide' or 'oxide-free' seals.

533.5 : 621.3.032.53 **120**
Metal-Ceramic Vacuum Seals.—N. T. Williams. (*Rev. sci. Instrum.*, June 1947, Vol. 18, No. 6, pp. 394–397.) A complete account of processes using AlSiMag 243 (2460 of 1947). Mixtures of Mo and carbonyl-iron powders are fired on to the ceramic at 1 400°C in a H-N atmosphere and to the surface thus obtained a Ni powder is sintered to provide a base for brazing. An alloy of 50% Fe, 50% Ni is used for outside seals and an alloy of 42% Ni, 5½% Cr, 52½% Fe for inside seals.

533.5 : 621.3.032.53 **121**
Ceramic-Metal Seals.—M. Kuhner. (*Le Vide, Paris*, Jan. 1947, No. 7, 11 pp. Reprint.) Discusses the advantages of using ceramics instead of glass in the construction of u.h.f. valves and describes processes for direct ceramic-metal seals without a glass intermediate.

533.5 : 621.315.616 **122**
The Vacuum Properties of Some Synthetic Dielectrics.—B. G. Hogg. (*Phys. Rev.*, 15th Sept. 1947, Vol. 72, No. 6, p. 522.) Summary of Amer. Phys. Soc. paper. An investigation to determine the suitability of some new dielectrics for use in the vacuum system of a mass spectrograph.

535.37 : 621.386 **123**
Microsecond Measurement of the Phosphorescence of X-Ray Fluorescent Screens.—F. Marshall. (*J. appl. Phys.*, June 1947, Vol. 18, No. 6, pp. 512–518.) The build-up and decay of light emitted by fluorescent materials when irradiated by X-ray pulses was displayed on a c.r.o.

537.228.1 **124**

Electromechanical Properties of Rochelle Salt at the Lower Curie Point.—R. M. Lichtenstein. (*Phys. Rev.*, 15th Sept. 1947, Vol. 72, No. 6, pp. 492–501.) The electromechanical constants calculated from measurements of the electrical characteristics near the lower Curie point agree with those determined for the upper Curie point. This fact furnishes an explanation of the existence of two Curie points for Rochelle salt.

537.228.1 : 546.431.823 **125**

Single Crystals of Barium Titanate.—B. T. Matthias, R. G. Breckenridge & D. W. Beaumont. (*Phys. Rev.*, 15th Sept. 1947, Vol. 72, No. 5, p. 532.) Summary of Amer. Phys. Soc. paper. Perfect single crystals of up to 5 mm were obtained by a cooling process not lasting longer than 8 hours. They were found to be strongly piezoelectric. " The dielectric behavior points to a new, third kind of ferro-electrics in addition to Rochelle salt and the dihydrogen phosphates."

537.228.1 : 546.431.823 **126**

Barium Titanate Crystals.—H. F. Kay & R. G. Rhodes. (*Nature, Lond.*, 26th July 1947, Vol. 160, No. 4056, pp. 126–127.) Crystals with linear dimensions up to 2 mm have been produced. They are piezoelectric at room temperatures and consist of individuals of tetragonal symmetry twinned about the 101 and 011 planes. Above 120°C there is a transition to cubic symmetry. See also 127 below.

537.228.1 : 546.431.823 : 621.315.612.4.011.5 **127**

Dielectric Properties of Single Crystals of Barium Titanate.—J. K. Hulm. (*Nature, Lond.*, 26th July 1947, Vol. 160, No. 4056, pp. 127–128.) At 18°C the permanent polarization characteristic is estimated at about 16 microcoulombs /cm^2. Curves showing maximum polarization as a function of temperature for various field strengths indicate a Curie temperature of about 124°C. See also 126 above.

537.311.33 **128**

The Physics of Electronic Semiconductors.—G. L. Pearson. (*Elect. Engng, N.Y.*, July 1947, Vol. 66, No. 7, pp. 638–642.) Long summary of A.I.E.E. paper. A short review of present knowledge with an elementary account of the band theory of solids, and the classifications of the various semiconductors. This theory explains the magnitude of the conductivity and its temperature coefficient, and also certain anomalies in sign of the Hall and thermoelectric effects. See also the work of A. H. Wilson (1932 Abstracts, p. 108).

537.311.33 : 621.396.622.6 **129**

Application of the Theory of Conduction in Semiconductors to Crystal Detectors.—Leblanc. (*See* 87.)

537.32 + 538.632] : 546.24 **130**

The Electrical Behavior of Vacuum Evaporated Tellurium.—W. Scanlon & K. Lark-Horovitz. (*Phys. Rev.*, 15th Sept. 1947, Vol. 72, No. 6, p. 530.) Summary of Amer. Phys. Soc. paper. Anomalies in the Hall effect and thermoelectric power of Te heated in air are absent when it is heated in a high vacuum.

538.221/.222 **131**

Relaxation Effects in Paramagnetic and Ferromagnetic Resonance.—C. Kittel. (*Phys. Rev.*, 15th Sept. 1947, Vol. 72, No. 6, p. 529.) Summary of Amer. Phys. Soc. paper. A theoretical discussion. The effects of anisotropy and exchange interactions on the condition $\omega = \gamma(BH)^{\frac{1}{2}}$ for ferromagnetic resonance are considered. See also *ibid.*, 15th Feb. 1947, Vol. 71, No. 4, p. 270, and 747 of 1947 (Griffiths).

538.221 + 669.018.5 **132**

Magnetic Alloys of High Permeability.—(*Engineer, Lond.*, 25th July 1947, Vol. 184, No. 4774, pp.78–79.) A review of the development of such materials, and an account of the properties of supermalloy, extracted from Boothby & Bozorth's paper (2802 of 1947).

538.221 + 669.018.5 **133**

The Production of Small Permanent Magnets.—(*Engineer, Lond.*, 11th July 1947, Vol. 184, No. 4772, p. 40.) A note on the use and properties of a new pressed powder material of high coercive force called ' Caslox,' manufactured by the Plessey Co. The material consists of a mixture of Fe-Co oxides with a plastic binder.

538.221 **134**

Variation of the Coercive Field as a Function of the Density of Compressed Ferromagnetic Powders.—L. Weil. (*C. R. Acad. Sci., Paris*, 28th July 1947, Vol. 225, No. 4, pp. 229–230.) Experimental verification, for powders of Fe and of Fe-Co with 30% Co, that the coercive field of compressed powder diminishes as the density increases, according to the formula $H_c = k(d - d_0)/d_0$, where k is a characteristic constant of the powder at infinite dilution, d the density of the solid metal and d_0 the mass of the ferromagnetic material per cm^3 in the compressed powder. See also 3151 and 3152 of 1947 (Néel). *Note.* In the text of the article it would appear that the definitions of d and d_0 should be interchanged.

538.221 **135**

Gyromagnetic Resonance in Ferrites.—J. L. Snoek. (*Nature, Lond.*, 19th July 1947, Vol. 160, No. 4055, p. 90.) A note on the experimental behaviour of magnetic ferrites of great homogeneity as a function of frequency. The rapid decrease of μ_0 at high frequencies is probably due to gyromagnetic resonance around directions prescribed by the internal fields.

538.221 : 621.317.41.029.63/.64 **136**

High-Frequency Permeability of Ferromagnetic Materials.—G. Eichholz & G. F. Hodsman. (*Nature, Lond.*, 30th Aug. 1947, Vol. 160, No. 4061, pp. 302–303.) A description of the technique used and the results obtained in the frequency band 2 300–3 400 Mc/s.

The permeability is deduced from measurement of the difference in attenuation constant of a coaxial transmission line when the inner conductor, made of the ferromagnetic material under test, is replaced by a non-magnetic material of the same dimensions.

Materials tested comprise Fe with low carbon content and steel (0.50–0.55% carbon) ; in both cases hard-drawn and white annealed specimens were used. Commercial Ni was also examined. See also 3923 of 1947 (Johnson, Rado & Maloof) and back references.

538.221 : 669.14-122.2 : 621.318.32 **137**

Cold-Worked Electrical Low Loss Steels.—(*Elect. Times*, 14th Aug. 1947, Vol. 112, No. 2910, pp. 177–181.) A description of the processing of silicon steel strip ' Crystalloy ' for minimum hysteresis loss. The steel is alternately cold-rolled in a Steckel mill and annealed, thus orienting the crystals with their edges parallel; the magnetic field must be applied parallel to the edges for minimum hysteresis loss. Typical curves and methods of testing are given.

546.289 : 538.56 **138**

Spontaneous Electrical Oscillations in Germanium Crystals.—S. Benzer. (*Phys. Rev.*, 15th Sept. 1947, Vol. 72, No. 6, p. 531.) Summary of Amer. Phys. Soc. paper.

546.289 : 621.315.59 : 536.48 **139**

Resistivity and Hall Constant of Germanium Samples at Low Temperatures.—I. Estermann, A. Foner & J. A. Randall. (*Phys. Rev.*, 15th Sept. 1947, Vol. 72, No. 6, p. 530.) Summary of Amer. Phys. Soc. paper.

546.289 : 621.315.59 : 536.48 **140**

Theory of Low Temperature Semiconductor Resistivity.—V. A. Johnson & K. Lark-Horovitz. (*Phys. Rev.*, 15th Sept. 1947, Vol. 72, No. 6, p. 531.) Summary of Amer. Phys. Soc. paper. The resistivity of Ge semiconductors has been calculated, using classical statistics above and Fermi statistics below the degeneracy temperature. The results are in close agreement with observations.

546.841-3 : 621.385.2.032.216 **141**

Thermionic Properties of Thoria.—D. A. Wright. (*Nature, Lond.*, 26th July 1947, Vol. 160, No. 4056, pp. 129–130.) A coating of thoria 0.1 mm thick was sprayed on to a Ta strip and incorporated in a diode. A saturated emission of 2.5 A/cm^2 was obtained under d.c. conditions at 1 900° K. 10 A/cm^2 under d.c. conditions and 30 A/cm^2 under pulsed conditions were obtained at 2 100° K without flashover. A thoria cathode was also made in tubular form by extrusion and sintering. The emission fell rapidly on continuous operation and the cathode was sensitive to thermal shock.

549.514.51 : 548.24 **142**

Artificial Electrical Twinning in Quartz Crystals.—J. J. Vormer. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1947, Vol. 35, No. 8, pp. 789–790.) For another account see 1463 of 1947.

549.514.51 : 621.396.611.21 **143**

FT-241A Frequency Control [quartz crystal] **Unit.**—I. E. Fair. (*Bell Lab. Rec.*, Aug. 1947, Vol. 25, No. 8, pp. 295–298.) Construction of a unit for 200–1 040 kc/s using CT- or DT-cut quartz plates, which are much smaller than AT-cut plates for a given frequency. Vibration in face shear and not thickness shear is used and a technique is developed for mounting the plates on small wires soldered at the nodal points.

549.514.51 : 621.396.611.21 : 621.386.001.8 **144**

A Method for the Determination of Crystal Cuts by applying the Reflection of X-Rays from a Known Lattice Plane.—V. Petržílka & J. Beneš. (*Phil. Mag.*, June 1946, Vol. 37, No. 269, pp. 399–410.) The method uses a Seemann electron diffraction spectrograph. The required information is derived from measurements on a single photograph.

621.315.612 : 537.523.3 **145**

High Altitude Flashover and Corona Correction on Small Ceramic Bushings.—W. W. Pendleton. (*Elect. Engng, N.Y.*, Sept. 1947, Vol. 66, No. 9, p. 925.) Summary of A.I.E.E. Dayton paper. Improvement of corona and flashover voltages was obtained by the use of semiconducting coatings. A sensitive oscilloscope method detects disturbances at voltage gradients where the ionization-by-collision process begins. These gradients are calculated from graphical maps of the dielectric fields associated with the bushings. A method is given for correlating flashover data with bushing size and shape.

621.315.612 : 621.319.4 **146**

Fabrication of Thin Ceramic Sheets for Capacitors.—G. N. Howatt, R. G. Breckenridge & J. M. Brownlow. (*J. Amer. ceram. Soc.*, 1st Aug. 1947, Vol. 30, No. 8, pp. 237–242.) Description of their manufacture and use as capacitor dielectrics. For TiO_2 sheets, graphs are given showing the relation of breakdown strength to thickness and temperature for a.c. and d.c. voltages. The dielectric properties of TiO_2 and of various titanates are tabulated.

621.315.616 : 546.287 **147**

Test of Silicones for Shipboard Use.—H. P. Walker. (*Elect. Engng, N.Y.*, July 1947, Vol. 66, No. 7, pp. 647–649.) Consideration of their possible uses as insulating varnishes, resins for laminated and moulded thermosetting materials, resins for high-temperature paints, bearing lubricants and rubber for gaskets.

621.315.616.7 **148**

Structural Features of GR-S Rubber.—W. G. Straitiff. (*Bell Lab. Rec.*, Aug. 1947, Vol. 25, No. 8, pp. 299–303.)

621.317.37 + 621.3.011.5] : 621.396.611.4 **149**

Resonant Cavities for Dielectric Measurements.—Works. (*See* 173.)

621.775.7 **150**

Powder Metallurgy. — (*Engineer, Lond.*, 18th July–22nd Aug. 1947, Vol. 184, Nos. 4773–4778, pp. 52–53, 72–73, 106–108, 119–121, 152–154 & 165–168.) A report of the discussion at the Institution of Civil Engineers on a symposium of 28 papers on various aspects of powder metallurgy, including magnetic powders and products.

621.775.7 **151**

Modern Powder Metallurgy.—H. W. Greenwood. (*Engineering, Lond.*, 13th June, 1947, Vol. 163, No. 4246, p. 492.) A general survey. Hitherto progress has been somewhat empirical. Planned investigation and fundamental research are now required.

669 **152**

New Metals for Old.—E. V. Appleton. (*Beama J.*, July 1947, Vol. 54, No. 121, pp. 256–259.) Summary of the Edward Williams lecture to the Institute of British Foundrymen on recent metallurgical research and its relation to the electrical engineering industry.

Increased tensile strength of overhead conductors, losses in magnetic substances, and improvements in magnetic hardness are discussed. Details are given of alloys having a high resistance to creep deformation under stress at high temperatures. Brief summary in *Nature, Lond.*, 30th Aug. 1947, Vol. 160, No. 4061, pp. 308–309.

MATHEMATICS

501(05) **153**

The Quarterly Journal of Mechanics and Applied Mathematics.—(*Nature, Lond.*, 27th Sept. 1947, Vol. 160, No. 4065, p. 427.) A new periodical beginning publication in April 1948.

517.512.2 : 518.4 **154**

Graphical Methods for evaluating Fourier Integrals.—W. J. Cunningham. (*J. appl. Phys.*, July 1947, Vol. 18, No. 7, pp. 656–664.) Three methods are described, all involving an analysis of the function considered into the sum of simpler functions whose transforms are known. The methods are useful where an analytic solution is too complicated or the data take the form of curves obtained experimentally.

517.512.2 : 621.396.67 **155**

Fourier Transforms in Aerial Theory : Part 3 — Operations with Fourier Transforms.—J. F. Ramsay. (*Marconi Rev.*, April/June 1947, Vol. 10, No. 2, pp. 41–58.) Continuation of 3561 of 1947. Discussion of elementary operations with Fourier transforms, namely : (*a*) change of sign of the independent variable, (*b*) interchange of function, (*c*) identity of function ; self-reciprocal transforms, (*d*) the Gaussian and Rayleigh transforms, (*e*) even and odd functions, (*f*) real and imaginary parts ; complex conjugates, (*g*) the displacement theorem, (*h*) multiplication by a constant, (*i*) change of scale, (*j*) addition and subtraction, (*k*) differentiation of transforms and (*l*) the transform of a product.

517.93 + 531 **156**

Introduction to Non-Linear Mechanics : Parts 1-4.—N. Minorsky. (*U.S. Navy : David W. Taylor Model Basin, Reports* 534, 546, 558 & 564.) These reports review the progress up to approximately 1940 in obtaining solutions to many kinds of nonlinear differential equations. Numerous examples are given, many of which are of an electrical nature. Much of the work is a presentation of material which has hitherto existed only in Russian books and papers. Part 1 is concerned with solutions by topological methods of qualitative integration, whilst part 2 gives an outline of the three principal analytical methods of Poincaré, van der Pol and Kryloff-Bogoliuboff. In part 3 there is a discussion of the complicated phenomena of nonlinear resonance, with its numerous ramifications, such as internal and external subharmonic resonance, entrainment of frequency and parametric excitation. Finally part 4 contains a review of the developments of Mandelstam, Chaikin and Lochakow in the theory of relaxation oscillations for large values of the parameter μ which appears in the basic quasi-linear equation

$$\ddot{x} + x = \mu F(x, \dot{x})$$

All analytical approaches to a solution of this equation assume that μ is very small, whereas for oscillations such as those conforming to van der Pol's differential equation μ is large.

518.5 **157**

Electrical Analogue Computing : Part 3 — Functional Transformation.—D. J. Mynall. (*Electronic Engng*, Aug. 1947, Vol. 19, No. 234, pp. 259–262.) Electromechanical and electronic devices are described for causing one quantity to vary as a predetermined function of another. The system is similar to that used for multiplication, but some of the potentiometers or variable resistors involved are nonlinear. Parts 1 and 2 : 3563 of 1947.

518.5 **158**

Electronic Computing Circuits of the ENIAC.—A. W. Burks. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1947, Vol. 35, No. 8, pp. 756–767.) "The design principles that were followed in order to insure reliable operation of the electronic computer are presented, and the basic types of computing circuits are analyzed. . . . The Eniac performs the operations of addition, subtraction, multiplication, division, square-rooting, and the looking up of function values automatically. The units which perform these operations, the units which take numerical data into and out of the machine, and those which control the over-all operation are described. The technique of combining the basic electronic circuits to perform these functions is illustrated by three typical computing circuits : the addition circuit, a programming circuit, and the multiplication circuit." See also 2481 of 1947 (Wilkes) and 3952 of 1947 (Hartree).

518.5 : 621.318 **159**

Use of Magnetic Amplifiers in Computing Circuits.—R. T. Beyer. (*Phys. Rev.*, 15th Sept. 1947, Vol. 72, No. 6, p. 522.) Summary of Amer. Phys. Soc. paper. These amplifiers have been used for the algebraic addition of small direct currents to an accuracy of ± 0.1% of the maximum sum and also for the differentiation of slowly varying voltages. The circuits have low input impedance, high stability, and the input levels of the currents can be independent of each other and of the output level.

518.5 : 621.392 **160**

Machine Computing of Networks.—L. A. Dunstan. (*Elect. Engng, N.Y.*, Sept. 1947, Vol. 66, No. 9, pp. 901–906.) The data and conditions of a standardized power distribution network problem are stated in the form of a master diagram, and the results are obtained by the use of punched card accounting machines. A comparison is made of this method with the network analyser method.

51 : 621.3 **161**

Modern Electrical Engineering Mathematics. [Book Review]—S. A. Stigant. Hutchinson's Scientific and Technical Publications, London, 1947, 372 pp., 31s. 6d. (*Beama J.*, July 1947, Vol. 54, No. 121, pp. 242–243.) ". . . a milestone in the application of modern mathematical methods to the solution of problems in complicated electrical networks."

51(083.5) **162**

The Mathematical Tables Project. [Book Notice] —National Bureau of Standards. Columbia University Press, New York. (*J. appl. Phys.*, July 1947, Vol. 18, No. 7, p. 687.) A list of 20 sets of tables published up to 1947 is given. These include powers, exponential and circular functions, probability functions, Bessel functions, Lagrangian interpolation coefficients, etc. See also 3339 of 1946 (Fletcher, Miller & Rosenhead).

MEASUREMENTS AND TEST GEAR

621.317.2 : 621.396.621.001.4 **163**

Chassis Testing on a Quantity Basis.—A. H. Beattie. (*Murphy News*, Aug. 1947, Vol. 22, No. 8, pp. 188–191.) The equipment consists of a central transmitter unit incorporating 24 individual crystal-controlled oscillators, which provide suitable signals for all chassis testing. The test points are fed through matched lines. Each oscillator is enclosed in an aluminium screening box. Each test point is provided with a buffer amplifier fitted with continuously variable output control, giving complete flexibility and permitting the use of low signal levels in the feeders.

621.317.311 **164**

A Method for the Measurement of Small Direct Currents.—E. J. Harris. (*Electronic Engng*, Aug. 1947, Vol. 19, No. 234, pp. 249–250.) The small e.m.f. to be measured is interrupted at 50 c/s and applied, in opposition to a variable known e.m.f., to the primary of a transformer. The secondary rings with an amplitude increasing with the difference between the known and unknown e.m.fs. The damped oscillations are amplified and applied to an oscilloscope which is used as a null detector.

621.317.32 : 537.533.73 **165**

Measurement of Peak High Voltages by Electron Diffraction.—J. J. Trillat & J. Barraud. (*Rev. gén. Élect.*, July 1947, Vol. 56, No. 7, pp. 310–314.) A method similar to that previously given for d.c. voltages (791 of 1947). The use of powdered magnesia or ZnO eliminates certain measurement errors. A peak voltage of 45 kV can be measured to within about ± 500 V.

621.317.33 : 621.316.8 **166**

Method for determining the Time Constant of Resistors at Low Frequency.—G. Ney. (*C. R. Acad. Sci., Paris*, 28th July 1947, Vol. 225, No. 4, pp. 227–228.) A semi-substitution method, using a Schering bridge, gives the self-inductance and the distributed capacitance of a resistor and hence its time constant. Measurements on numerous metallized resistors show that the distributed capacitance is practically negligible and Ohm's law is followed up to frequencies of many hundreds of kc/s. Measurements on resistors of 1 to 100 000 Ω show, in general, errors in determining the time constant of the order of 10^{-9} sec.

621.317.332 **167**

Conductivity of Metallic Surfaces at Microwave Frequencies.—E. Maxwell. (*J. appl. Phys.*, July 1947, Vol. 18, No. 7, pp. 629–638.) Two methods of measurement which have been used at λ 1.25 cm are described. The first involves the measurement of the s.w.r., and hence the transmission loss, in a shorted waveguide; the second involves the measurement of the Q of a resonant cavity. The results for a number of metals are given. Deviations from d.c. conductivity are ascribed to surface roughness.

621.317.335 **168**

A Capacitance Test Bridge.—J. M. Heinrich. (*Radio News*, Aug. 1947, Vol. 38, No. 2, pp. 42–43.. 150.) A direct reading instrument for capacitances between 1 pF and 100 μF.

621.317.335 **169**

Connection Errors in Capacitance Measurements.—R. F. Field. (*Gen. Radio Exp.*, May 1947, Vol. 21, No. 12, pp. 1–4.) Stray capacitance errors are largely eliminated by use of a wire of small diameter for connection to the high potential terminal, the wire being curved so as to increase its average distance from earthy conductors. Correction of the residual error is applied by observing the effect of varying the initial separation of the end of the wire and the terminal.

621.317.361 + 621.317.761 **170**

Royal Observatory Standard Frequency Transmissions.—(*R.S.G.B. Bull.*, Aug. 1947, Vol. 23, No. 2, p. 24.) Brief details are given of the 2-Mc/s standard frequency transmissions from Abinger. The accuracy is better than 1 in 10^7.

621.317.361 + 621.317.761 **171**

WWV Standard Frequency Broadcasts.—W. W. George. (*F.M. & Televis.*, June 1947, Vol. 7, No. 6, pp. 25–27..44.) Details of the various transmissions, with photographs of some of the equipment.

621.317.37 + 621.3.011.5] : 621.365.92 **172**

Dielectric Loss at High Frequency.—J. B. Whitehead. (*Elect. Engng, N.Y.*, Sept. 1947, Vol. 66, No. 9, pp. 907–911.) A calorimetric substitution method of measuring the dielectric properties of a material whose temperature may be changing at a rate of the order of 50°F/min. For another account see *Science*, 20th June 1947, Vol. 105, No. 2738, p. 637.

621.317.37 + 621.3.011.5] : 621.396.611.4 **173**

Resonant Cavities for Dielectric Measurements.—C. N. Works. (*J. appl. Phys.*, July 1947, Vol. 18, No. 7, pp. 605–612.) The susceptance variation method of measuring dielectric constant and dissipation factor, widely used in the frequency range 10 kc/s–100 Mc/s, is extended to frequencies up to 1 000 Mc/s. Fixed and variable length re-entrant resonant cavities are described; the specimens are in the form of small disks. Design principles are discussed and formulae given for calculating the required dielectric properties. Good agreement is found with values measured by other methods. Some results for typical dielectrics are shown graphically.

621.317.382.029.63 **174**

A Coaxial Load for Ultra-High-Frequency Calorimeter Wattmeters.—W. R. Rambo. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1947, Vol. 35, No. 8, pp. 827–829.) Design considerations and description of a broad-band water load for operation in the frequency band 1 000–3 000 Mc/s at input levels within the range 5–150 W. Dimensions are 9 inches long by $\frac{3}{8}$ inch in diameter. See also 2172 of 1947 (Shaw & Kircher).

621.317.41 **175**

A Method of measuring Magnetic Permeability for Weak Fields and a Wide Range of Frequencies.—I. Épelboïm. (*C. R. Acad. Sci., Paris*, 29th Sept.

1947, Vol. 225, No. 13, pp. 535–537.) An account of the method used at the Sorbonne and at the Laboratoire National de Radioélectricité. The demountable coil previously described (797 of 1947) can be used for frequencies up to 12 Mc/s in the most favourable case. A new coil extends the range to 25 Mc/s and two others now under construction should enable measurements to be made to 100 Mc/s. Preliminary results are quoted for powdered-iron cores of low μ and relatively large cross-section and for permalloy strip.

621.317.41 **176**

A Permeameter for Magnetic Measurements on High Permeability Material.—W. J. Carr, Jr. (*Phys. Rev.*, 15th Sept. 1947, Vol. 72, No. 6, p. 530.) Summary of Amer. Phys. Soc. paper. The magnetic force is measured by placing a small winding with a high permeability core very close to the surface of the test specimen. The core is energized with a.c. above the knee of its magnetization curve and the second harmonic of the voltage is a measure of the field in the specimen.

621.317.42 : 621.317.755 **177**

A Cathode-Ray B-H Tracer.—J. Zamsky. (*Elect. Engng, N.Y.*, July 1947, Vol. 66, No. 7, pp. 678–680.) Two coils are used to pick up voltages from the test sample in a magnetic circuit and apply them by means of an electronic circuit to the vertical (flux density B) and the horizontal (magnetic intensity H) sets of deflecting plates of the c.r. tube. The B coil encloses the sample, the H coil is inside it. The magnetic properties are deduced from photographs of the c.r. traces. See also 2247 of 1946 (Long & McMullen).

621.317.43 **178**

Apparatus for measuring Power Loss in Small Ferromagnetic Samples subject to an Alternating Magnetic Field.—K. H. Stewart. (*J. sci. Instrum.*, June 1947, Vol. 24, No. 6, pp. 159–162.) For samples about 15 cm × 1 cm × 0.03 cm. Includes a B_{max} meter and a wattmeter in which the a.c. quantities to be measured are balanced against d.c. quantities, thus allowing all readings to be made on d.c. meters.

621.317.7 **179**

Electrical and Acoustical Instruments shown at the Physical Society's Exhibition [1947].—T. B. Rymer. (*J. sci. Instrum.*, June 1947, Vol. 24, No. 6, pp. 148–151.) An account of a few of the exhibits, including the following: (*a*) A spectrum analyzer for the output of a klystron, using a cavity resonator whose piston is vibrated by a loudspeaker unit, causing the resonance frequency to vary harmonically. The output from the wavemeter is applied to the y-plates of a c.r.o. whose x-plates are fed from the a.c. source operating the loudspeaker. (*b*) A complete test set for radar installations. (*c*) A standard frequency generator capable of producing substantially pure frequencies of any integral number of kc/s from 2 kc/s to 10 Mc/s with an accuracy of 3 parts in 10^7. (*d*) Counting and pulse circuits. (*e*) Moving-coil meters, including a d.c. instrument of 100 000 Ω/V resistance. (*f*) A supersonic flaw detector. (*g*) An electroencephalograph with an 8-pen recorder. (*h*) Magnetic variometers with sensitivity which can be adjusted from 10^{-4} gauss/division upwards, the usual value being 3×10^{-4} gauss/division. See also 3581 of 1947 and back references.

621.317.733 **180**

A Wide-Frequency-Range Capacitance Bridge.—R. F. Field & I. G. Easton. (*Gen. Radio Exp.*, April 1947, Vol. 21, No. 11, pp. 1–7.) The R.C.A. capacitance bridge type 716-C is a Schering bridge circuit adapted for capacitance measurements up to 1 000 pF over the frequency range 30 c/s to 300 kc/s, and up to 1 μF at 1 kc/s.

621.317.733 **181**

A V.H.F. Bridge for Impedance Measurements between 20-140 Mc/s.—R. A. Soderman. (*Communications*, Aug. 1947, Vol. 27, No. 8, pp. 26–27.) Summary of New England Radio Engineering meeting paper. For measurements on lumped-parameter circuits, or on distributed-parameter circuits using coaxial transmission lines. A modified Schering bridge circuit is used, whereby both the resistive and the reactive components of the unknown impedance are measured in terms of incremental capacitances.

621.317.733 **182**

The Maxwell Bridge at Low Frequencies.—V. A. Brown & B. P. Ramsay. (*Phys. Rev.*, 15th Sept. 1947, Vol. 72, No. 6, p. 528.) Summary of Amer. Phys. Soc. paper. The bridge has been used to measure inductance and a.c. resistance at periods of 1–200 sec. Application to inductances of several hundred henries, with solid ferromagnetic cores, is mentioned.

621.317.738.029.5 **183**

R.F. Inductance Meter.—H. A. Wheeler. (*Electronics*, Sept. 1947, Vol. 20, No. 9, pp. 105–107.) Two r.f. oscillators, one with the unknown inductance in series and the other with a variable capacitance in parallel, are tuned to zero beat. Direct-reading accuracy is within 1% from 1 μH to 100 mH.

621.317.755 : 621.396.621.001.4 **184**

Qualities and Defects of Alignment by the Oscilloscope.—J. Bernhardt. (*Toute la Radio*, Sept. 1947, Vol. 14, No. 118, pp. 237–240.) A discussion of the various possible sources of error in lining up the h.f. and i.f. stages in receivers by means of a c.r.o., including the oscillograph itself and its associated amplifier, the detector and amplifier stages of the receiver and the generator. The errors are found to be considerable only in extreme cases.

621.317.757 : 534.442.1 **185**

Electronic Indicator for Low Audio Frequencies.—Hastings. (*See* 5.)

621.317.763 **186**

Wavemeter of High Accuracy.—R. Aschen. (*T.S.F. pour Tous*, July/Aug. 1947, Vol. 23, Nos. 225/226, p. 150.) The instrument uses a tuned circuit with unscreened interchangeable coils to give different ranges. This circuit is connected through small capacitors to the cathode and grid of a magic-eye tuning indicator mounted for anode detection. Damping of the tuned circuit is thus suppressed, which accounts for the sensitivity. Heater and anode voltages for the indicator are provided by a transformer without rectification. Overall size is 13 cm by 6 cm by 9 cm.

621.317.784 **187**

A Milliwattmeter for Power Measurements in the Super Frequency Band of 8 700-10 000 Mc/s.—W. Rosenberg. (*J. sci. Instrum.*, June 1947, Vol. 24, No. 6, pp. 155–158.) For waveguide measurements for powers from 7 μW to 7 mW. The power-sensitive element is a thermistor bead. A substitution method is used in which d.c. power and r.f. power are assumed equivalent. Since mean power is measured, the meter can be used for either c.w. or pulse transmissions. Estimated accuracy is 6%.

621.317.789 : 621.385.1.032.22 **188**

A Calorimetric Method for Direct Measurement of Plate Dissipation.—R. T. Squier. (*Elect. Engng, N.Y.*, Sept. 1947, Vol. 66, No. 9, p. 927.) Summary of A.I.E.E. Dayton paper. The discriminator section of an amplifier circuit is considered and the difficulties encountered in determining anode dissipation are analysed. The construction and operation of the calorimeter used to overcome these difficulties is described.

621.317.79 : 621.3.015.33 **189**

Pulse Rise and Decay Time Measurement.—A. Easton. (*Electronics*, Sept. 1947, Vol. 20, No. 9, pp. 180..190.) The various parameters to be measured (rise, fall, overshot, etc.), are discussed briefly. A method of measurement in which the pulse is applied to the x-plates and a synchronized sinusoidal timing wave is applied to the y-plates of a c.r. tube is described. A differentiating circuit, operated by the pulse, blanks out the return trace. High accelerating voltages must be used to ensure that the time of rise or fall of the pulse occupies most of the tube face. See also 1599 of 1946.

621.317.79 : 621.396.611.21 **190**

Quartz Beat-Frequency Oscillator.—A. V. J. Martin. (*Toute la Radio*, Sept. 1947, Vol. 14, No. 118, pp. 253–256.) Full circuit details and lay-out of an instrument using in the fixed-frequency oscillator crystals of frequencies 2 000, 2 002, 2 004, 2 006 and 2 008 kc/s, any one of which may be selected. The variable-frequency oscillator also uses a quartz crystal, whose frequency is varied between 999 and 1 000 kc/s by altering the crystal air-gap. Frequency doubling gives a range from 1 998 to 2 000 kc/s, so that when combined with the fixed-frequency oscillations, the range from 0 to 10 000 c/s is covered in 5 steps. Distortion is low and stability excellent.

621.317.79 : 621.396.813 **191**

Distortion Meter.—R. Besson. (*Toute la Radio*, Sept. 1947, Vol. 14, No. 118, pp. 242–244.) Circuit details and lay-out of an instrument comprising supply unit, amplifier, valve voltmeter and a simple type of T-filter using a single inductance with a number of capacitors selected by a switch.

621.317.79 : 621.397.62.001.4 **192**

Visual Alignment of Television Receivers.—M. H. Kronenberg. (*Radio News*, Aug. 1947, Vol. 38, No. 2, pp. 64–65..122.) Method of using an f.m. signal generator, in conjunction with an auxiliary c.r. tube for aligning the various stages.

621.317.791 **193**

Design and Construction of a Universal Meter.—A. V. Howland. (*R.S.G.B. Bull*, Aug. 1947, Vol. 23, No. 2, pp. 22–24.) The circuit diagram and component values are given for a universal meter to measure a.c. and d.c. voltage, d.c. current, and resistance, using a 0–1-mA moving coil meter and a 1-mA bridge-connected instrument rectifier. A buzzer is incorporated for continuity testing.

621.317.794 **194**

Construction and Characteristics of Evaporated Nickel Bolometers.—B. H. Billings, E. E. Barr & W. L. Hyde. (*Rev. sci. Instrum.*, June 1947, Vol. 18, No. 6, pp. 429–435.) The bolometers described are approximately 200 Å thick and are evaporated on to a nitrocellulose pellicle about 1 000 Å thick, which is supported on a glass base with a sand-blasted groove below the bolometer strip. A typical bolometer has a time constant of 0.004 sec and a threshold of 3.3×10^{-8} W for radiation modulated at 30 c/s, the bandwidth being 100 c/s.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

531.775 : 621.317.361 **195**

Measuring Speed with WWV.—J. C. Coe. (*Electronics*, Aug. 1947, Vol. 20, No. 8, pp. 90–93.) The a.f. output of a variable-reluctance tachometer generating 2 000 c/s at 30 000 r.p.m. is compared with the output of a variable-frequency oscillator, which is calibrated by means of harmonics of the standard 440-c/s signal broadcast by station WWV.

539.16.08 **196**

On the Rise of the Wire-Potential in Counters.—S. A. Korff. (*Phys. Rev.*, 15th Sept. 1947, Vol. 72, No. 6, pp. 477–481.) An analysis of the factors which determine the rate of change of wire-potential. Experimental work in support of the theoretical predictions is quoted.

551.508.1 : 621.396.9 **197**

The Kew Radio Sonde.—E. G. Dymond. (*Proc. phys. Soc.*, 1st July 1947, Vol. 59, No. 334, pp. 645–666.) A radio transmitter of frequency 26–30 Mc/s is modulated by an audio oscillator whose frequency is controlled in turn by temperature, pressure and humidity units. The modulation thus gives the values of these three quantities in the neighbourhood of the balloon carrying the transmitter. A detailed description is given of the apparatus, and its accuracy is discussed. See also 4263 of 1938 (Thomas).

621.318 **198**

Applications of Magnetic Amplifiers.—W. E. Greene. (*Electronics*, Sept. 1947, Vol. 20, No. 9, pp. 124–128.) The magnetic amplifier, essentially a saturated core reactor in which the current in an auxiliary winding controls that in the main winding by varying the permeability of the high-μ core, was first used in 1916. It was superseded by the electronic amplifier until the Germans, employing high-μ cores and Se rectifiers, used it for servo-mechanism amplifiers during the war. The mechanical strength and low ohmic losses make the amplifier suitable for many post-war applications. Research is proceeding to overcome the slowness of response at very low frequencies, an inherent fault, and to produce better core materials. By using feedback, power gains of 10^4 have already been obtained.

621.319.339.027.3 **199**

The Imperial College High-Voltage Generator.—W. B. Mann & L. G. Grimmet. (*Proc. phys. Soc.*, 1st July 1947, Vol. 59, No. 334, pp. 699–703.) "The design and construction of two pressure-insulated electrostatic generators similar to those of Van de Graaff and Trump are briefly described. Voltage tests with one of the generators with mixtures of nitrogen and freon under pressure have shown it to be capable of producing voltages in excess of two million."

200

621.319.43 : 621.317.79 : [531.718.4 + 531.787.9

A Variable Capacitor for Measurements of Pressure and Mechanical Displacements; A Theoretical Analysis and Its Experimental Evaluation.—J. C. Lilly, V. Legallais & R. Cherry. (*J. appl. Phys.*, July 1947, Vol. 18, No. 7, pp. 613–628.) The capacitor consists of a fixed plane electrode and a parallel diaphragm, which is clamped at the edges. Small displacements, volume changes or pressure differences, acting upon the diaphragm, are deduced by electrical measurement of the resulting change in capacitance.

621.365.5.001.8+621.365.92.001.8 **201**

Practical Applications of H.F. Induction and Dielectric Heating.—M.J.A. (*Toute la Radio*, Sept. 1947, Vol. 14, No. 118, pp. 233–236.) A discussion of the frequencies and the various types of equipment suitable for particular purposes.

621.365.92 : [621.317.37+621.3.011.5 **202**

Dielectric Loss at High Frequency.—Whitehead. (*See* 172.)

621.38 : 629.13.054 **203**

Precision Balancing at Mass-Production Speed.—S. Bousky. (*Electronics*, Sept. 1947, Vol. 20, No. 9, pp. 98–104.) The periphery of a gyro rotor is stamped with a series of numbers; unbalance at any point is indicated when a stroboscopic lamp illuminates the corresponding number. Full constructional details and operational procedure are given. A rotor can be balanced to within 5×10^{-6} oz-inches in 2 minutes.

621.38/.39].001.8 : 629.13 **204**

Electronics and Aeronautical Research.—(*Engineering, Lond.*, 25th July 1947, Vol. 164, No. 4252, p. 91.) An account of equipment on view at an exhibition arranged by the Instrumentation Department, R.A.E., Farnborough, including various types of acceleration and pressure pickups, multichannel recording equipment, 4-way c.r. equipment, 600-way static strain recording equipment, transmitting and statistical accelerometers and an electronic torque-meter. See also *Engineer, Lond.*, 25th July 1947, Vol. 184, No. 4774, pp. 85, 87.

621.383.001.8 : 551.591 : 535.247.4 **205**

Visibility Measurements by Transmissometer.—C. A. Douglas. (*Electronics*, Aug. 1947, Vol. 20, No. 8, pp. 106–109.) The intensity of light incident on a phototube up to 4 000 ft away from a fixed 350 000-cp source is recorded continuously, using pulse technique.

621.384 **206**

An Electron Accelerator with an Air-Cored Field.—R. D. Hill. (*Nature, Lond.*, 7th June 1947, Vol. 159, No. 4049, pp. 774–775.) The electric field, produced by a pulsed 25-cm magnetron, having recurrence frequency 100 per sec, pulse width 1 μs and peak power 200 kW, is fed to dees by a Lecher wire system. The dees are 2 cm deep, have a radius of 5 cm and contain a tungsten filament and a target. The focusing static field is 425 gauss and the dynamic field 300 gauss at the peak of a sinusoidal 250-kc/s oscillation. Absorption curves show that the inclusion of a dynamic field results in an increased X-ray yield of harder radiation.

621.384 : 621.396.611.4 **207**

Experiments in Multiple-Gap Linear Acceleration of Electrons.—W. D. Allen & J. L. Symonds. (*Proc. phys. Soc.*, 1st July 1947, Vol. 59, No. 334, pp. 622–629.) Design and construction details of a 3-stage cavity for the acceleration of electrons up to 0.85 MeV. The cavity is fed with power from a 500-kW magnetron operating at λ 10 cm.

621.384.6 **208**

The Acceleration of Charged Particles to Very High Energies.—M. L. Oliphant, J. S. Gooden & G. S. Hide. (*Proc. phys. Soc.*, 1st July 1947, Vol. 59, No. 334, pp. 666–677.) A synchrotron is being built at Birmingham University to accelerate protons to 1 000 MeV. The advantages of the technique and the design of the magnet and its excitation are described in detail. Electron energies up to 300–400 MeV are possible, higher energies being prevented by radiation loss. For proton energies above 10^{10} eV, the cost of this method would be prohibitive. For theory see 209 below.

621.384.6 **209**

Theory of the Proton Synchrotron.—J. S. Gooden, H. H. Jensen & J. L. Symonds. (*Proc. phys. Soc.*, 1st July 1947, Vol. 59, No. 334, pp. 677–693.) The phase oscillations of an accelerated particle are analysed for the non-relativistic and the relativistic cases. The influence and control of the eight significant forces on the oscillation amplitude are discussed. Injection and the consequent radial oscillations are considered. Numerical data and graphs for the case of the Birmingham synchrotron (208 above) are given.

621.385.832 **210**

A Memory Tube.—Haeff. (*See* 319.)

621.385.833 **211**

The Design and Construction of an Electron Microscope.—M. E. Haine. (*Engineering, Lond.*, 4th July 1947, Vol. 164, No. 4249, pp. 20–24.) Long summary of I.E.E. Measurements Section paper giving details of the Metropolitan-Vickers Type EM2 electron microscope. The general construction, the procedure for aligning the electron gun and magnetic lenses, and the operating and photographic techniques are described in detail. The instrument is continuously pumped, uses an accelerating voltage of 25–50 kV and gives a magnification of 10 000 diameters.

621.385.833 **212**

Improvements in the Electrostatic Microscope.—H. Bruck & P. Grivet. (*Ann. Radioélect.*, July 1947, Vol. 2, No. 9, pp. 244–248. In English.)

Details of a smaller power unit, a new design of Wehnelt cylinder and anode, and a focusing system involving no mechanical movement. See also 3706 of 1946 and 3236 of 1947.

621.385.833 **213**

A New Electron Microscope with Continuously Variable Magnification.—J. B. le Poole. (*Philips tech. Rev.*, 1947, Vol. 9, No. 2, pp. 33–45.) An electron microscope constructed at Delft in 1944 is fully described and compared with previous models. Its resolving power is 25 Å and its magnification is continuously variable from 1 000 to 80 000 diameters. Various applications are mentioned.

621.385.833 **214**

Influence of Mechanical Defect of the Objectives on the Resolving Power of the Electrostatic Microscope.—F. Bertein, H. Bruck & P. Grivet. (*Ann. Radioélect.*, July 1947, Vol. 2, No. 9, pp. 249–252. In English.) A mathematical analysis of the dependence of resolving power upon aberration constant, two values of which correspond to (*a*) ellipticity defects and (*b*) off-centre defects. See also 3236, 3238, 3613 and 3614 of 1947.

621.385.833 **215**

A Space-Charge Lens for the Focusing of Ion Beams.—D. Gabor. (*Nature, Lond.*, 19th July 1947, Vol. 160, No. 4055, pp. 89–90.) Suggested design for a powerful concentrating lens for positive ions, particularly those of extreme energy. Means are described for maintaining a suitable space charge inside a hollow cylinder using electrons derived from an auxiliary ring-shaped cathode. The focal length of the lens is expected to increase only linearly with the energy of the ion beam, and the design should enable lenses of relatively short focal length to be made.

621.385.833 **216**

Spherical Aberration of Compound Magnetic Lenses.—L. Marton & K. Bol. (*J. appl. Phys.*, June 1947, Vol. 18, No. 6, pp. 522–529.)

621.386.1 **217**

X-Ray Tube with Very Bright Line Focus.—M. Poittevin. (*C. R. Acad. Sci., Paris*, 16th June 1947, Vol. 224, No. 24, pp. 1709–1711.) Details of a tube with curved filament located in a groove cut across the face of a semi-cylindrical concentration piece. The apparent brightness is 30 kW/mm^2 when the apparent dimensions of the focus are those of a square of side 0.1 mm.

621.396.9 : 623.26 **218**

Metal Locator with Remote Field Source.—(*Beama J.*, Aug. 1947, Vol. 54, No. 122, p. 271.) Description and photograph of ERA Mine Locator No. 7. The magnetic field is generated by a cable fed by a.c. and laid on the ground in a large loop, instead of by the search unit. Its operating range is therefore not limited by the magnetic properties of the ground.

621.396.9 : 623.454.25 **219**

The Radio Proximity Fuse.—H. M. Bonner. (*Elect. Engng, N.Y.*, Sept. 1947, Vol. 66, No. 9, pp. 888–893.) See also 3619 of 1947 and back references.

623.978+550.838] : 538.71 **220**

Air-Borne Magnetometers.—E. P. Felch, L. G. Parratt, W. J. Means, L. H. Rumbaugh, T. Slonczewski & A. J. Tickner. (*Elect. Engng, N.Y.*, July 1947, Vol. 66, No. 7, pp.680–685.) An inductor with an open core of highly permeable and easily saturable material, such as permalloy, is placed in the unknown field, with a superposed sinusoidal magnetomotive force large enough to saturate the core. The time variation of the core flux induces an e.m.f. in a coil surrounding the core ; this e.m.f. is fed into an electronic circuit and there analysed. The sensitivity increases with the length of the core, but is limited by the highest impedance which can be maintained at the grid of the first valve with satisfactory stability. With a 1.5-inch length the sensitivity exceeds 10 $\mu\text{V}/\gamma$ ($1\ \gamma = 10^{-5}$ oersted). The detector-inductor is kept parallel to the magnetic field by the controlling action, through servomotors, of two auxiliary inductors. The apparatus records variations in the sum of the squares of the outputs of all three inductors, hence giving the variations of the unknown field. See also 3245 of 1947 (Shackelton).

621.365.5+621.365.92 **221**

Theory and Application of Radio-Frequency Heating. [Book Review] — G. H. Brown, C. N. Hoyler & R. A. Bierwirth. D. Van Nostrand, New York, 1947, 370 pp., $6.50. (*Electronics*, Sept. 1947, Vol. 20, No. 9, pp. 258, 260.)

621.38/.39].001.8 **222**

Electronic Developments. [Book Review]—R. G. Britton. George Newnes, London, 206 pp., 7s. 6d. (*Electronic Engng*, Aug. 1947, Vol. 19, No. 234, p. 268.) " This book will be of value even to those already acquainted with many applications of electronic science, and a well-balanced survey of such an important subject is something new in more than one sense."

PROPAGATION OF WAVES

538.566 **223**

Calculation of the Interaction between Two Particles from the Asymptotic Phase.—C. E. Fröberg. (*Phys. Rev.*, 15th Sept. 1947, Vol. 72, No. 6, pp. 519–520.) Proof that it is formally possible to calculate the potential from the asymptotic phase of a wave function. Convergence is not considered. A fuller account will appear in *Ark. Mat. Astr. Fys.*

538.566 : 621.396.11 **224**

The Field of a Microwave Dipole Antenna in the Vicinity of the Horizon.—C. L. Pekeris. (*J. appl. Phys.*, July 1947, Vol. 18, No. 7, pp. 667–680.) Three cases are treated in which the transmitter or receiver is either on the ground or elevated. For very short waves the field at points on the horizon approaches that of the direct wave diffracted by a straight edge at the point of tangency. The results are compared graphically with the exact theory of van der Pol and Bremmer (2249 of 1939 and back references). When both transmitter and receiver are on the ground the potential can be expressed as the sum of a surface wave for a flat earth and an integral depending upon the earth radius, these two terms tending to cancel at large distances.

538.566.2 **225**

The Structure of an Electromagnetic Field in the Neighbourhood of a Cusp of a Caustic.—T. Pearcey. (*Phil. Mag.*, May 1946, Vol. 37, No. 268, pp. 311–317.) " A detailed mathematical and numerical study of the field structure at and near a line focus of a cylindrical electromagnetic wave train possessing any finite amount of cylindrical aberration of the first order."

621.396.11 **226**

A Method for Calculating Electric Field Strength in the Interference Region.—H. E. Newall, Jr. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1947, Vol. 35, No. 8, p. 777.) Brief summary only. For an interference region, over a spherical earth, which has an effective radius equal to four-thirds that of the earth. The accuracy is limited by the great number of graphical steps involved, but the procedure has given ' very useful working estimates '.

621.396.11 **227**

Circularly Polarized Waves give Better F.M. Service Area Coverage.—T. B. Friedman. (*Tele-Tech*, Aug. 1947, Vol. 6, No. 8, pp. 26–30..102.) A discussion of the theory and practical applications of circularly polarized radiation, and its advantages in certain cases of f.m. reception.

621.396.11 : 551.510.535 **228**

Some Observations of the Maximum Frequency of Radio Communication over Distances of 1 000 km and 2 500 km.—W. J. G. Beynon. (*Proc. phys. Soc.*, 1st July 1947, Vol. 59, No. 334, pp. 521–534. Discussion, p. 535.) The maximum usable frequencies for radio transmission from s.w. broadcasting stations near Berlin and Moscow were deduced from observations at Slough of the field strength variations around sunrise and sunset. The results were compared with theoretical values deduced from vertical-incidence ionospheric measurements at Slough and at Burghead (Scotland), and the mean discrepancies of the calculated values with respect to those observed were found to be −3% for Berlin and −11% for Moscow.

A discussion is given of the factors involved in applying vertical incidence ionospheric data to oblique incidence transmission, and it is concluded that the main source of the discrepancy lay in the inadequate knowledge of ionospheric conditions at the midpoint of the trajectory.

621.396.11 : 551.510.535 **229**

A Frequency Prediction Service for Southern Africa.—F. J. Hewitt, J. Hewitt & T. L. Wadley. (*Trans. S. Afr. Inst. elect. Engrs*, July 1947, Vol. 38, Part 7, pp. 180–193. Discussion, pp. 193–197.) A discussion of existing facilities and the proposed short-term predictions of ionospheric disturbances. The nature of the observed data and the prediction methods are described. As local data over a number of years do not exist, back data from Australian records are used, suitably modified according to present observations in South Africa. A new design of recorder uses a double superheterodyne transmitter-receiver. The frequency is swept from a few hundred kilocycles to 20 Mc/s in one band ; the only moving part is the rotor of the main sweeping oscillator. Automatic frequency calibration is provided. The complete sweep takes 10 seconds and the display on a long afterglow c.r. tube is suitable for visual or fully automatic photographic recording.

621.396.11 : 551.510.535 **230**

How Daytime Skywave Reflections affect Cleared Channels.—(*Tele-Tech*, Aug. 1947, Vol. 6, No. 8, pp. 45–47.) Report on a conference organized by the F.C.C. at which evidence was produced suggesting that day-time sky-wave reflections could cause interference in the 550–1 600 kc/s band. Little information was available as to why this occurred.

621.396.81 : 621.396.712 **231**

A Developmental F.M. Broadcast Station.—Honnell. (*See* 269.)

621.396.812.3 : 621.397.5 : 551.594.21 **232**

Television and Thunderstorms.—E. G. Hill. (*Wireless World*, Sept. 1947, Vol. 53, No. 9, p. 344.) Increased television signal intensity from a station 90 miles away, two or three hours prior to a thunderstorm, has been observed.

RECEPTION

621.396.61/.621 : 621.396.931 **233**

F.M. Receiver Design for Rail Radio Service.—Martin. (*See* 309.)

621.396.61/.621].029.6 **234**

Transmitter-Receiver, 280-330 Mc/s.—Dieutegard. (*See* 308.)

621.396.619 + 621.396.621.54 **235**

Heterodyning and Modulation.—C. J. Mitchell. (*Wireless World*, Oct. 1947, Vol. 53, No. 10, p. 359.) A simplified comparison of additive and multiplicative mixing, indicating that both frequency changing and modulation are multiplicative processes, irrespective of the method employed.

621.396.619 : 621.396.662 **236**

Design of Tuners for A.M. and F.M.—L. M. Hershey. (*Tele-Tech*, Aug. 1947, Vol. 6, No. 8, pp. 58–59..95.) " Automatic frequency control, using dual triode as oscillator and reactance tube corrects for mistuning and drift ; pushbutton tuning." See also 237 below.

621.396.619.13 : 621.396.621 **237**

F.M. Reception Problems and Their Solution.—(*Electronics*, Sept. 1947, Vol. 20, No. 9, pp. 108–113.) A summary of the following I.R.E. Section papers. Antennas for F.M. Receivers, by N. W. Aram. R.F., I.F. and A.F.C. Circuits, by L. M. Hershey. Limiters and Frequency Detectors, by M. Hobbs.

621.396.621 + 621.396.69 **238**

British Printed and Sprayed Circuits.—(*Tele-Tech*, Aug. 1947, Vol. 6, No. 8, pp. 52–53..97.) Summary of 1913 of 1947 (Sargrove).

621.396.621 **239**

Adjustable-Bandwidth F.M. Discriminator.—W. G. Tuller & T. P. Cheatham, Jr. (*Electronics*, Sept. 1947, Vol. 20, No. 9, pp. 117–119.) The performance of a Foster-Seeley discriminator (2543 of 1937), in which the conventional pentode drive is replaced by a cathode follower, is analysed and discussed. 4 : 1 variation of bandwidth is readily obtained, and the normalized output is independent of bandwidth. The arrangement is, however, liable to be less sensitive than the pentode drive for large deviations, and larger bandwidths are required for a given amount of distortion. Experimental results and a circuit operating on 60 Mc/s are given.

621.396.621 **240**

Cathode-Coupled Converters for Surplus Receivers.—J. H. Bender. (*QST*, Aug. 1947, Vol. 31, No. 8, pp. 37–42.) A single-valve crystal-controlled adaptor for 28 Mc/s; the principle can be extended to higher frequencies. The tuning controls and calibration of the BC-779 receiver remain unaltered. A twin triode in the converter acts as a fixed tuned-oscillator mixer. Its output is cathode-coupled to the receiver, which then functions as a tunable i.f. amplifier.

621.396.621 : 371.3 **241**

Broadcast Reception for Schools. — (*Wireless World*, Sept. 1947, Vol. 53, No. 9, pp. 327–329.) A description of an 'approved' installation. The power amplifiers are capable of 20 W output, although an output of 30 mW is found to be sufficient for one classroom. The effective frequency range of the installation, including the loudspeaker, is 60–8 000 c/s.

621.396.621 : 629.114.6 **242**

Radio Receivers for Motor Vehicles.—G. Giniaux. (*T.S.F. pour Tous*, July/Aug. 1947, Vol. 23, Nos. 225/226, pp. 151–155.) A general account of typical rotary-converter and vibrator h.v. supplies, aerials, noise suppressors, etc., with brief particulars of a number of commercial sets.

621.396.621.001.4 : 621.317.755 **243**

Qualities and Defects of Alignment by the Oscilloscope.—Bernhardt. (*See* 184.)

621.396.621.029.62 + 621.396.662.029.62 **244**

Design of F.M. Receiver Front Ends.—A. R. Miccioli & D. Pollack. (*Tele-Tech*, July 1947, Vol. 6, No. 7, pp. 40–43.) Development of tuners and methods of reducing frequency drift of local oscillators. See also 3259 of 1947 (Miner).

621.396.621.029.62 **245**

Experimental Findings in connection with the Design of V.H.F. Frequency-Modulation Receivers.—R. S. Zucker. (*Proc. Instn Radio Engrs, Aust.*, June 1947, Vol. 8, No. 6, pp. 19–24.) Data obtained from actual practical experience are applied to specific problems encountered in the various stages. No systematic general treatment is attempted.

621.396.621.029.62 **246**

Harvey Double Superheterodyne F.M. Receiver.—B. J. Cosman & A. W. Richardson. (*F.M. & Televis.*, June 1947, Vol. 7, No. 6, pp. 21–24 . . 52.) Circuit details and description of a commercial receiver covering the frequency range 85–115 Mc/s with a bandwidth of 250 kc/s. Limiter action occurs at 1 μV aerial input and the i.f. frequencies are 10.7 Mc/s and 4.6 Mc/s, the latter being crystal controlled. Audio amplifier response is linear from 20 to 15 000 c/s.

621.396.621.53 **247**

Simple Converter-Preselector.—F. C. Jones. (*CQ*, June 1947, Vol. 3, No. 6, pp. 31–34 . . 70.) "A unit to give broadcast band, 15- 10- and 6-meter coverage, as well as preselection on other bands, for a receiver with limited tuning range."

621.396.622.71 **248**

Ratio Detector for F.M. Signals.—(*Tele-Tech*, July 1947, Vol. 6, No. 7, pp. 46–49.) Modifications to the balanced discriminator circuit for conversion from f.m. to a.m. are described which make it independent of input amplitude variations due to fading, to multipath reflection effects, to selectivity effects in the r.f. or i.f. stages or to unbalances in the detector itself. See also 3643 of 1947 (Seeley & Avins).

621.396.722 **249**

The Development of a Receiving Station for the B.B.C. Monitoring Service.—R. D. A. Maurice & C. J. W. Hill. (*B.B.C. Quart.*, July 1947, Vol. 2, No. 2, pp. 105–128.) A detailed description with circuit diagrams and photographs of the war-time development of the B.B.C. monitoring receiving stations first at Evesham, and later at Caversham and Crowsley. The object of the service was to listen to all forms of foreign broadcast, and distribute the information obtained to Government departments. At Evesham the stronger signals were received by omnidirectional aerials, amplified, and conveyed by buried coaxial cables to receivers remotely located in a region relatively free from interference; directive aerials were used for the weaker, long-distance signals. At Caversham and Crowsley an improved 'amplified aerial system' supplied over 100 receivers; 8 wide-band octave amplifiers fed 3 coaxial lines so that the frequency bands on any one line were at least 2 octaves apart.

621.396.722 : 621.396.65 **250**

A Traffic Receiver : The RECRO 451.—Juillet. (*See* 264.)

621 396.822 : 538.523 **251**

Electromagnetic Background Noise due to Sea Waves.—Y. Rocard. (*C. R. Acad. Sci., Paris*, 7th July 1947, Vol. 225, No. 1, pp. 50–51.) Sea waves may give rise to such noise owing to the periodic motion of their conductive elements in the earth's magnetic field. The effect may be appreciable for l.f. reception; its magnitude is calculated approximately.

621.396.822 : 621.317.755 **252**

Random Fluctuations in a Cathode Ray Oscillograph.—N. R. Campbell & V. J. Francis. (*Phil. Mag.*, May 1946, Vol. 37, No. 268, pp. 289–310.) A mathematical paper. The basis for the treatment employed is that noise is the resultant of superposed effects of events that occur at random times. The chance $W(y)dy$ is calculated that the deflection of the trace at a snap reading is between y and $y + dy$. The mean frequency with which the trace cuts a given level, and the mean frequency of 'peaks' and 'troughs' at a given level, are calculated. The intractable problem of determining the duration of a 'hill' above a given level is discussed. A final section briefly indicates a possible method of representing the reaction between any steady signal present and the noise. See also 1037 of 1946.

621.396.823 **253**

Ignition Interference : Part 1. Its Nature, Magnitude and Measurement.—W. Nethercot. (*Wireless World*, Oct. 1947, Vol. 53, No. 10, pp. 352–357.) A comprehensive account of unpublished reports by the Electrical Research Association on the mechanism of the ignition spark and the field strength of the radiation. Curves and tables are given of the variation of field strength with frequency up to 650 Mc/s, distance, azimuth and polarization. Factors affecting the fundamental radiation, such as the position and length of the ignition leads, are discussed. See also 4020 of 1947 (Turney).

621.396.828 **254**

Curing Interference to Television Reception.—M. Seybold. (*QST*, Aug. 1947, Vol. 31, No. 8, pp. 19–23..110.) A detailed account of methods of harmonic suppression applied to a 14-Mc/s transmitter to improve a neighbour's television reception. Full-power transmitter operation was subsequently possible.

621.396.828 : 621.396.1 **255**

Installations for Improved Broadcast Reception.—P. Cornelius & J. van Slooten. (*Philips tech. Rev.*, 1947, Vol. 9, No. 2, pp. 55–63.) A method of diversity reception is used to eliminate selective fading. Three identical sets of receiving equipment are situated about 2 km apart. Voltages E_1, E_2 and E_3, which increase with the signal strength, are fed from each of the receivers to the corresponding valves V_1, V_2 and V_3 of a three-valve switching circuit of the Eccles-Jordan type, of which a diagram is given. If E_1 is the greatest of the voltages, the switching circuit is only stable with V_1 carrying a high anode current and V_2 and V_3 carrying practically no anode current.

Interference from other transmitters on neighbouring frequencies is counteracted by using directive frame aerials. The freedom from disturbance thus obtained enables the bandwidth of the receiving set to be increased, thus improving the quality of the reproduction.

621.396.621.004.67 **256**

Most-Often-Needed 1947 Radio Diagrams and Servicing Information. [Book Review]—M. N. Beitman (Ed.). Supreme Publications, Chicago, 1947, 189 pp., $2.00. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1947, Vol. 35, No. 8, p. 806.) Continuation of 1056 of 1947. The period covered is the latter part of 1946 and early 1947.

STATIONS AND COMMUNICATION SYSTEMS

621.395.43 : 621.392.029.64 **257**

The Exploitation of Micro-Waves for Trunk Wave-Guide Multi-Channel Communications.—H. M. Barlow. (*J. Brit. Instn Radio Engrs*, Oct. 1947, Vol. 7, No. 6, pp. 251–257. Discussion, pp. 257–258.) The use of H_{01} waves in a cylindrical waveguide at 40 000 Mc/s is suggested. Attenuation would be about 6 db per mile, making repeaters at 8-mile intervals necessary when using a 1.5-inch diameter copper waveguide. The repeaters would convert the carrier to a lower frequency and, after amplification, use this signal to re-modulate a new carrier on 40 000 Mc/s. Thousands of speech channels on a single waveguide would be possible.

The waveguide might also be used as a 132-kV, 50-c/s power line.

621.395.43 : 621.396.619.16 **258**

Pulse Code Modulation Method for Multi-Channel Telephony.—R. R. Batcher. (*Tele-Tech*, July 1947, Vol. 6, No 7, pp 28–33.) Description of a system of modulation in which the variations of amplitude of the speech wave control the amplitude of short pulses at a sampling rate that will give at least two pulses per cycle at the highest audio frequency, but many more at the lowest. The pulse amplitude variations are transmitted over the system by a special five-digit code permitting the handling of 32 levels. Coding and decoding methods are described. The system is stated to be distortionless and free from cumulative noise effects on long circuits. For another account of this system by H. S. Black see *Bell Lab. Rec.*, July 1947, Vol. 25, No. 7, pp. 265–269.

621.396(99) **259**

Electronics in the Antarctic.—H. C. Bailey. (*Electronics*, Aug. 1947, Vol. 20, No. 8, pp. 82–88.) An account of the apparatus used and the difficulties met on a U.S. Navy expedition. Includes radar and sonar for ships among icebergs, radar and G.C.A. (ground controlled approach) for air navigation, radio for communications and broadcasting, teletype and radio-photo and an airborne magnetometer for aerial surveying.

621.396.611.21 : 621.316.726.078.3 : 621.396.712 **260**

The Problem of Synchronization in Broadcasting Networks.—M. Toussaint & A. Sev. (*Ann. Radioélect.*, July 1947, Vol. 2, No. 9, pp. 253–269.) A general discussion, with a critical examination of the different factors affecting the stability of a quartz oscillator. The synchronization equipment of the Société Française Radioélectrique is described. This uses crystals of frequency between 90 and 130 kc/s, with suitable multiplication stages, and a frequency stability of the order of 10^{-8} is achieved by use of a novel thermostat. Control apparatus for aligning a slave station to the network master frequency with high accuracy uses a stroboscopic phase-meter.

621.396.619.11/13 : 621.396.97 **261**

The Relative Merits of Frequency Modulation and Amplitude Modulation as applied to a Broadcasting Service.—B. J. Stevens & E. J. Middleton. (*Trans. S. Afr. Inst. elect. Engrs*, May 1947, Vol. 38, No. 5, pp. 141–157. Discussion, pp. 157–162.) A comprehensive review of the two types of modulation is followed by some details of the development of f.m. broadcast equipment by the South African Broadcasting Corporation.

621.396.65 **262**

Mobile V.H.F. Radio Telephone.—(*Electrician*, 11th July 1947, Vol. 139, No. 2, p. 117.) A description of a single-unit transmitter-receiver having a maximum current consumption of 10 A from a 12-V heavy-duty battery and output of 6 W on any limited frequency band in the v.h.f. range. Either a.m. or f.m. can be used. The equipment weighs 16$\frac{2}{3}$ lb, and its overall dimensions are 9$\frac{3}{4}$ inches by 7$\frac{3}{4}$ inches by 8 inches.

621.396.65 **263**

A Frequency-Modulated Multi-Channel V.H.F. Radio Link.—E. S. Teltscher. (*Electronic Engng*, Aug. 1947, Vol. 19, No. 234, pp. 256–258.) A f.m. adaptor is used in place of the ordinary modulator, in order to obtain a higher degree of linearity and reduce cross-talk between the channels.

621.396.65 : 621.396.722 **264**

A Traffic Receiver : The RECRO 451.—M. Juillet. (*Ann. Radioélect.*, July 1947, Vol. 2, No. 9, pp. 270–282.) The functions of a central receiving station for long-distance radiotelephony and radiotelegraphy are outlined and an account is given of diversity receiving equipment constructed by the Société Française Radioélectrique.

621.396.65 : 621.397.5 **265**

Television Extensions.—(*See* 297.)

621.396.65.029.64 **266**

Early Centimetre-Wave Communication Systems.—J. C. Dix. (*Engineering, Lond.*, 13th June 1947, Vol. 163, No. 4246, p. 489.) A brief outline of development up to 1941, including a 15-mile 9-cm R/T land link used for joint research by the Admiralty Signal Establishment and the G.E.C. in 1941, and Army Wireless Set No. 10.

621.396.712 **267**

Modern A.M. Broadcast Station Arrangement.—(*Tele-Tech*, July 1947, Vol. 6, No. 7, pp. 38–39.) Illustrations of the 50-kW equipment at Omaha.

621.396.712 : 621.396.61 **268**

Mountain-Top F.M. Installation.—M. Cady. (*Communications*, July 1947, Vol. 27, No. 7, pp 12–13 . . 39.) Description of the installation of a 3-kW transmitting station with 3-bay turnstile aerial on top of a mountain. Results of preliminary trials are given.

621.396.712 : 621.396.81 **269**

A Developmental F.M. Broadcast Station.—M. A. Honnell. (*Communications*, July 1947, Vol. 27, No. 7, pp. 20–21.) A 1-kW 99-Mc/s experimental aerial was placed on a 45-ft tower 1 080 ft above sea level. Propagation measurements to determine f.m. coverage are still in progress ; the area is wooded and hilly.

621.396.721 + 621.395.623.8] : 625.232 **270**

Passenger Entertainment Systems for Railroad Use.—J. A. Curtis. (*Tele-Tech*, July 1947, Vol. 6, No. 7, pp. 34–37 . . 97.) Equipment giving radio or wire recorder programmes and train announcements.

621.396.86 : 621.397 **271**

Secret Message Transmission by Facsimile.—(*Telegr. Teleph. Age*, Aug. 1947, Vol. 65, No. 8, pp. 8 . . 30.) Secrecy is achieved by ' scrambling ' the transmission, the scanning drum being driven at varying speeds by a synchronous motor which follows frequency variations in the supply current. The scrambler frequency generator consists of three chopper disks or wheels driven at constant but different speeds. Each chopper wheel has a series of perforations whose spacing determines the frequency of impulse pickup in associated photoelectric cells. The outputs from these cells are mixed and multiplied to obtain a mean frequency of 1 800 c/s, giving a supply current which may be used to drive the scanning drum either for scrambling or unscrambling.

621.396.931/.932 **272**

Mobile Radio-Telephone.—(*Wireless World*, Oct. 1947, Vol. 53, No. 10, p. 357.) For police and fire services. The compact a.m. unit receives power from a 12-V car battery, and the transmitter has an output of 10 W in the 78–100 Mc/s band. The receiver is a pre-tuned double superheterodyne using the fundamental and the third harmonic of a crystal oscillator, the first i.f. being about 45 Mc/s and the second i.f. 5 Mc/s ; bandwidth is 50 kc/s at −3 db, to permit reception of transmissions from several headquarters in different locations on slightly different frequencies using a common modulation source. The same receiver with a different power unit is used for the fixed headquarters installation, where the transmitter delivers about 50 W r.f. to the aerial. See also *Elect. Rev., Lond.*, 1st Aug. 1947, Vol. 141, No. 3636, p. 174, *Engineering, Lond.*, 8th Aug. 1947, Vol. 164, No. 4254, p. 138, and 2246 of 1947 (Austin).

621.396.931/.932 **273**

Two-Way Broadcast via Train-to-Station to Ship-at-Sea Link.—D. E. Noble. (*Communications*, July 1947, Vol. 27, No. 7, pp. 8–11.) Description of a v.h.f. link used between a train and a radio station for the purpose of a broadcast from the train to a ship at sea. A phase-modulated duplex system working on frequencies in the region of 160 Mc/s was used and contact was maintained for distances up to 15 miles from the radio station.

621.396.931.029.62 **274**

Mobile F.M. Communications Equipment for 30 to 44 Mc/s : Part 2.—R. B. Hoffman & E. W. Markow. (*Communications*, Aug. 1947, Vol. 27, No. 8, pp. 34–35.) Conclusion of 3665 of 1947.

621.396.933 : 621.398 **275**

Telecontrol of Aeradio Ground Station Receivers.—J. E. Benson & W. A. Colebrook. (*Proc. Instn Radio Engrs, Aust.*, June 1947, Vol. 8, No. 6, pp. 8–15.) A general discussion of radio communication services for civil aviation was given by Newstead (3425 of 1946). A crystal locked 3-channel telecontrolled receiver installation operating in the 0.3-, 3-, and 6-Mc/s frequency bands is described. The outputs from the receivers are conveyed over three independent telephone lines which also serve for the d.c. potentials used for switching from c.w. to speech, and for switching on and off the power supply and preset test oscillator.

SUBSIDIARY APPARATUS

621-526 : 621.396.615.14 **276**

Automatic Frequency Control of Microwave Oscillators.—V. C. Rideout. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1947, Vol. 35, No. 8, pp. 767–771.) A technique applicable to any type of tunable microwave oscillator is described. In this method a servomechanism is used which includes a waveguide discriminator circuit, a mercury-contact relay which vibrates at 60 c/s and is used to convert the discriminator output into 60-c/s square waves, a 60-c/s amplifier and a small 2-phase induction motor. A stability of 1 part in 50 000 is obtainable. The application of the technique to microwave repeater operation is described.

621.314.58 **277**

A D.C. Mains-Operated Vibratory Inverter.—E. E. Cornelius. (*Proc. Instn Radio Engrs, Aust.*, June 1947, Vol. 8, No. 6, pp. 16–18.) Using the potential gradient across a charging capacitor in opposition to the applied voltage, and a suitable

LC product to conform to the vibrator frequency, the potential applied across the contacts of a vibrator can be reduced to a low value before contact break, minimising arcing, and enabling vibrators to be used on power supply voltages.

An interference-free unit has been constructed on this principle, to operate from 220-V d.c. mains and to provide 500 W of a.c. energy at 250 V. The conversion efficiency was 65%–80% over the operating range of load resistance. R.f. interference was easily suppressed to a level adequate for the operation of a commercial communications receiver at maximum sensitivity on all bands, with the remaining noise down to residual receiver noise level.

621.317.722.1.076.8 **278**

An Inductively Coupled Degenerative High Voltage Stabilizer.—R. Pepinsky & P. Jarmotz. (*Phys. Rev.*, 15th Sept. 1947, Vol. 72, No. 6, p. 529.) Summary of Amer. Phys. Soc. paper. The d.c. connection between the series-valve grid circuit and the input error voltage leads to insulation problems in very-high-voltage supplies. These are overcome by allowing the control amplifier to modulate a 2-Mc/s oscillator whose output passes through a transformer before being rectified and applied to the grid of the series valve. The transformer is designed to withstand the required high voltage across the windings.

621.318.572 **279**

An Electronic Multicircuit Breaker.—G. D. Hanchett, Jr. (*QST*, Aug. 1947, Vol. 31, No. 8, pp. 34–36.) Simple overload protection for transmitting gear.

621.318.572 : 621.398 **280**

R.F. Operated Remote Control Relay.—D. G. Fink. (*Electronics*, Sept. 1947, Vol. 20, No. 9, pp. 114–116.) The relay, which consumes no standby power, responds directly to the current in a receiving aerial. It closes on 8–10 mV, r.f. It is operated by a tuned circuit and crystal, and actuates a power relay. It can be used at unattended stations or as a carrier-failure alarm.

621.396.68 **281**

The Characteristics of Power Supplies for Radio Transmitters.—W. E. Pannett. (*Marconi Rev.*, April/June 1947, Vol. 10, No. 2, pp. 33–40.) " Discusses the nature of the load of a radio transmitter on the source of power supply, and the economics involved in the provision of power from supply mains or generating plant. An analysis is made of the effects of voltage and frequency variations and cyclic disturbance on the performance of transmitter equipment. From these considerations suitable tolerances of the supply characteristics are deduced for various classes of transmission."

621.396.68 : 621.314.222 **282**

The Theory and Practice of Constant Voltage Transformers for Radio Power Supplies : Part 1.—R. H. Burdick. (*Marconi Rev.*, April/June 1947, Vol. 10, No. 2, pp. 59–71.) The reasons for using constant voltage transformers are discussed. The use of a bucking winding, to reduce the operating flux density for the saturated iron-cored reactors required for these transformers, is explained. The effect of the ratio of the bucking winding to the main winding on the stabilized output voltage is considered and a series capacitor scheme is outlined. For constant voltage operation, the product $\mu_{ac} H_{rms}$ is constant. For the stabilized condition the secondary voltage is independent of the number of primary turns. The effect of frequency is indicated. Types of iron circuit and typical loss figures are reviewed. Power factor control is shown to depend on the number of primary turns.

621.396.682 : 621.316.722.1 **283**

Low-Voltage [high current] **Regulated Power Supplies.**—F. W. Smith, Jr, & M. C. Thienpont. (*Communications*, July 1947, Vol. 27, No. 7 pp. 22 . . 43.) Voltage regulation obtained by feeding the output voltage back through a d.c. amplifier to control a saturable reactor in the a.c. input circuit. Characteristics of a 6-V, 14-A supply are given.

621.396.682 : 621.316.722.1 **284**

Design of Regulated Power Source.—L. L. Helterline, Jr. (*Tele-Tech*, July 1947, Vol. 6, No. 7, pp. 63–65 . . 107.) A description of the Sorensen Nobatron stabilized d.c. supply device. A bridge circuit incorporating a mains-heated, temperature-limited diode in one arm is used, and voltage variations of the a.c. supply cause changes of grid potential in a beam power valve. The corresponding anode current changes vary the impedance of a transformer winding connected as part of a potential divider regulating the input to the metal rectifier. 0.5% regulation and 1% ripple voltage are claimed.

621.396.682 : 621.316.722.1 **285**

Voltage-Regulated Power Supplies.—L. Mautner. (*Elect. Engng, N.Y.*, Sept. 1947, Vol. 66, No. 9, pp. 894–900.) The basic series type regulator circuit is analysed ; it can be regarded as a cathode follower. Methods of obtaining low internal impedance and low output ripple are discussed. Various typical reference-voltage connections and the necessity for a stable feedback amplifier are considered. Five circuits for specific applications are given, together with calculated performance data. See also 4046 of 1947 (Koontz & Dilatush).

621.396.682 : 621.397.62 **286**

[5-kV] **E.H.T. Supply for Television Receivers.**—C. H. Banthorpe. (*Electronic Engng*, Aug. 1947, Vol. 19, No. 234, p. 245.) The line-scan sawtooth waveform is applied to the control grid of a pentode. The sudden cutting off of the anode current at flyback causes a coil in the anode circuit to ring. The high oscillatory voltage generated is rectified by a diode whose heater power is provided by a small coil coupled magnetically to the ringing coil.

621.396.69 **287**

Maintenance Masts for B.B.C.—(*Engineer, Lond.*, 1st Aug. 1947, Vol. 184, No. 4775, p. 110.) A description of two transportable masts which may be quickly erected near permanent masts for use while maintenance work is done on the main installation. They are triangular, parallel sided, 300 ft high and insulated for 20 kV r.m.s. There are 18 sections of total weight 4¼ tons including fittings.

778 : 621.396.619.23 : 621.396.96 **288**

Photographing Pulse Wave Shapes of Radar Modulators.—L. W. Marks. (*Tele-Tech*, July

1947, Vol. 6, No. 7, pp. 60–62 . . 103.) Small variations from the required shape of the output pulse of radar modulators may cause serious loss of power, double moding, misfiring and frequency modulation of the associated transmitter. In production testing the pulse wave shape is photographed for comparison with a standard to diagnose possible sources of trouble. Equipment for this purpose is described.

TELEVISION AND PHOTOTELEGRAPHY

621.397(73) **289**

Facsimile is Ready for Home Use.—M. B. Sleeper. (*F.M. & Televis.*, June 1947, Vol. 7, No. 6, pp. 19–20 . . 55.) In America, facsimile is now commercially practicable, and transmission standards are required. A definition of 103 lines/inch and a paper speed of 3.43 inches/min have been agreed upon and paper widths of 4.1 and 8.2 inches are proposed. Recorders using a width of 8.2 inches are expensive and require a flat frequency response range beyond that of the average f.m. set. Once a public facsimile service has been instituted, its use will spread rapidly.

621.397.26 **290**

V.H.F. Link for Press Photos.—(*Electronics*, Aug. 1947, Vol. 20, No. 8, pp. 100–102.) A mobile equipment for picture transmission scanning at 90 lines per minute and using an 1 800-c/s a.m. tone for the picture gradations. Transmission time for a 5-inch by 7-inch photograph is about six minutes.

621.397.331.2 **291**

Improvements in Electronic Television Cameras.—P. Hémardinquer. (*T.S.F. pour Tous*, July/Aug. & Sept. 1947, Vol. 23, Nos. 225/226 & 227, pp. 163–165 & 191–193.) Descriptions of the iconoscope or emitron, the super-emitron, the orthiconoscope, the image orthiconoscope and their mode of operation; also of the isoscope of Barthélemy and a method of modulation resembling somewhat the superheterodyne method used in radio receivers.

621.397.335 **292**

Sync Generator Frequency Stability and TV Remote Pickups.—W. J. Poch. (*Communications*, July 1947, Vol. 27, No. 7, pp. 14 . . 39.) Locking the synchronizing generator to the power supply has advantages where power supply frequency variation is small. The generator can also be locked to a crystal oscillator; in this case wire or radio links may be needed for maintaining a close relationship between vertical blanking signals. Pulse timing and amplitude during switching are also considered.

621.397.5 **293**

The Verdict of the F.C.C.—(*Télévis. franç.*, June 1947, No. 26, Supplement *Électronique*, p. 17.) (*a*) No colour television for 5 years. (*b*) Immediate start of black-and-white television on the present line standard. (*c*) Laboratories are invited to continue research in order to achieve an absolutely flawless colour television system.

621.397.5 **294**

The French [line] **Standard.**—(*Télévis. franç.*, June 1947, No. 26, Supplement *Électronique*, p. 17.) The Comité Mixte de Télévision, at the session of 28th May 1947, has decided (*a*) to maintain for 10 years the present line standard for the Paris district and (*b*) to put into service in about 2 years a high-definition standard of about 1 000 lines.

621.397.5 : 535.88 **295**

A New Television Projection System.—W. E. Bradley & E. Traub. (*Electronics*, Sept. 1947, Vol. 20, No. 9, pp. 84–89.) Combination of a Schmidt optical system, a new fluorescent phosphor, directional viewing screen, and keystone projection, produces a 15 inch × 20 inch picture of exceptional brightness and contrast.

621.397.5 : 535.88 : 532.62 **296**

Theoretical Studies of the Use of Quasi-Insulating Eidophors for Large-Screen Television Projection.—H. Thiemann. (*Schweiz. Arch. angew. Wiss. Tech.*, May–Aug. 1947, Vol. 13, Nos. 5–8, pp. 147–154, 175–182, 210–217 & 239–252.) A continuation of previous work (3080 of 1941 and 1736 of 1942). The term eidophor is applied to a thin layer of a viscous fluid whose surface deformation can be used for television projection. The wiping out of the surface charges on the eidophor with the help of secondary emission is fully discussed and a general theory is presented of the electro-hydrodynamical problems associated with the deformation of the surface of liquid eidophors of finite thickness. Picture production methods are described and stability conditions considered. See also 554 of 1947.

621.397.5 : 621.396.65 **297**

Television Extensions.—(*Elect. Times*, 12th June 1947, Vol. 111, No. 2901, p. 675.) A brief general description of the 1 000-Mc/s link, now under construction, to carry normal 405-line, 50-frame/sec signals from the Alexandra Palace to the relay station in Birmingham.

Three successive optical paths will be used, one of 20 miles and two of 40 miles, with 80-ft towers at the intermediate stations. For another account see *Elect. Rev., Lond.*, 13th June 1947, Vol. 140, No. 3629, p. 984.

621.397.5 : 621.396.65 **298**

F.C.C. Studies TV Relays for Inter-City Network Systems.—(*Tele-Tech*, Aug. 1947, Vol. 6, No. 8, pp. 34–37.) Report of conference organized by the F.C.C. Several links are already in operation, and the system between New York, Philadelphia, Pittsburgh and Washington is practically complete. The New York/Chicago link of 900 miles will use 35 repeaters, and an aerial system operating uniformly over the band 3 700–4 200 Mc/s.

621.397.5 : 621.396.812.3 : 551.594.21 **299**

Television and Thunderstorms.—Hill (*See* 232.)

621.397.62 **300**

The R.C.A. Television Receiver Type 630.—M. Chauvierre. (*Radio franç.*, ? July 1947, pp. 12–17.) An account of some of the principal features, with a complete circuit diagram. 13 stations having frequencies between 44 and 216 Mc/s can be received.

621.397.62 **301**

The Philips [television] **Receiver with Screen Projection.**—(*Radio franç.*, ? July 1947, p. 18.) A short description of the projection system and the h.v. supply unit.

621.397.62 **302**

Bush Television Model T91.—(*Wireless World*, Sept. 1947, Vol. 53, No. 9, pp. 323–326.) Straight circuit for vision: superheterodyne for sound. Picture size is 7½ inches by 6 inches.

621.397.62 **303**

Build Your Own Television Receiver.—L. S. Wecker & T. Gootée. (*Radio News*, Aug. 1947, Vol. 38, No. 2, pp. 45–48..139.) The construction and adjustment of a receiver covering all channels from 44 to 88 Mc/s, which can be built from the components and chassis of a war-surplus oscilloscope, Type BC-412, with a Type 5BP4 c.r. tube.

621.397.62 **304**

Television Receiver Construction: Part 8.—(*Wireless World*, Oct. 1947, Vol. 53, No. 10, pp. 391–396.) Construction and assembly details. For previous parts see 4056 of 1947 and back references.

621.397.62 : 621.314.67 **305**

Pulsed Rectifiers for Television Receivers.—Maloff. (*See* 311.)

621.397.62.001.4 : 621.317.79 **306**

Visual Alignment of Television Receivers.—Kronenberg. (*See* 192.)

TRANSMISSION

621.396.61 : 621.396.41 **307**

An Inexpensive Rig for Local Duplex Operation.—D. D. Ralston. (*QST*, Aug. 1947, Vol. 31, No. 8, pp. 52–53.) Low-power equipment for R/T on 11 m.

621.396.61/.621].029.6 **308**

Transmitter-Receiver, 280-330 Mc/s.—J. Dieutegard. (*Toute la Radio*, Sept. 1947, Vol. 14, No. 118, pp. 246–251.) Three distinct units are included: (*a*) the oscillator-detector, (*b*) the amplifier-modulator and (*c*) the supply unit. The oscillator uses an acorn valve Type 955 and tuning is effected by Lecher lines with a variable bridge, the whole system being enclosed in a metal tube, with suitable coupling for the doublet aerial. Constructional and circuit details are given.

621.396.931 : 621.396.61/.621 **309**

F.M. Receiver Design for Rail Radio Service.—D. W. Martin. (*Communications*, Aug. 1947, Vol. 27, No. 8, pp. 14–17..37.) Circuit details of a f.m. receiver-transmitter for use in the band 152–162 Mc/s. The receiver has a modified single superheterodyne circuit using half-frequency mixing to reduce reradiation and spurious responses. Special cone wound coils are used in the temperature-compensated i.f. transformers. Figures are given for sensitivity and selectivity.

VALVES AND THERMIONICS

537.533.8 **310**

Present State of Knowledge of Secondary Electron Emission from Solids.—Palluel. (*See* 89.)

621.314.67 : 621.397.62 **311**

Pulsed Rectifiers for Television Receivers.—I. G. Maloff. (*Electronics*, Aug. 1947, Vol. 20, No. 8, pp. 110–111.) "Brief analysis of pulsed cascade rectifiers used in television receivers indicates that no component is subjected to potentials substantially higher than those encountered per section. In a doubler, this voltage is about half the output voltage from the rectifier."

621.383.5 **312**

The Photoelectric Mechanism of Selenium Barrier Layer Elements.—A. E. Sandström. (*Phil. Mag.*, May 1946, Vol. 37, No. 268, pp. 347–356.) Mott's theory of the e.m.f. of oxide photoelements is applied to Se elements. See also 3593 of 1945.

621.385 + 621.396.694 **313**

Tube Registry.—(*Electronics*, Aug. 1947, Vol. 20, No. 8, p. 232.) Characteristics of the 6AS6G pentode voltage amplifier and the 5594 xenon-filled thyratron. See also 3711 of 1947 and back references.

621.385.1.032.216 **314**

Rectification Characteristics of an Oxide Cathode Interface.—W. E. Mutter. (*Phys. Rev.*, 15th Sept. 1947, Vol. 72, No. 6, p. 531.) Summary of Amer. Phys. Soc. paper.

621.385.1.032.216 **315**

Some Electrical Properties of an Oxide Cathode Interface.—A. Eisenstein. (*Phys. Rev.*, 15th Sept. 1947, Vol. 72, No. 6, p. 531.) Summary of Amer. Phys. Soc. paper.

621.385.2.032.216 : 546.841-3 **316**

Thermionic Properties of Thoria.—Wright. (*See* 141.)

621.385.1.032.22 : 621.317.789 **317**

A Calorimetric Method for Direct Measurement of Plate Dissipation.—Squier. (*See* 188.)

621.385.831 : 537.533.8 : 621.397.6 **318**

Secondary-Emission Amplifier Tube.—M. Chauvierre. (*Tele-Tech*, July 1947, Vol. 6, No. 7, pp. 69..105.) A description of the construction and mode of operation of the EE 50 (Philips) single-stage, secondary-emission valve. Electrons from the cathode impinge upon the secondary-emission cathode; the secondary electrons constitute the anode current. The transconductance (14 000 micromhos) is considerably greater than that of a conventional valve. To prevent disturbance of the secondary emission process by volatilization of the cathode, a screen is interposed between it and the secondary emission cathode. The use of the valve in wide-band amplifiers is mentioned.

621.385.832 **319**

A Memory Tube.—A. V. Haeff. (*Electronics*, Sept. 1947, Vol. 20, No. 9, pp. 80–83.) Operation is based on secondary emission. A pattern is first produced, then stored, and later scanned on a dielectric screen, each operation being performed by a separate electron beam. Uses include the three-dimensional presentation of radar data and the automatic recording and reproduction of transients.

MISCELLANEOUS

621.396 **320**

British Research in the Radio Field. [Book Review]—Institution of Electrical Engineers, London, 1s. (*Electrician*, 8th Aug. 1947, Vol. 139, No. 3608, p. 396 : *Beama J.*, Sept. 1947, Vol. 54, No. 123, p. 298.) A review of work at present in progress. The importance of effective coordination is stressed and it is recommended that a bureau should be set up, possibly under the Department of Scientific and Industrial Research, to disseminate details of research work.

ABSTRACTS AND REFERENCES

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to the World List practice.

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ACOUSTICS AND AUDIO FREQUENCIES

534.41 **321**

Industrial Stethoscopes.—(*Overseas Engr*, July 1947, Vol. 20, No. 237, pp. 388–389.) A commercial sound detecting instrument for locating and comparing noises in machinery or detecting flow in or leakage from water mains, etc. Two forms are available, one for testing external sound when direct contact with the test part is impossible and the other for contact application.

534.75 **322**

Monaural Problems of Hearing.—H. Mol. (*Tijdschr. ned. Radiogenoot.*, Sept. 1947, Vol. 12, No. 5, pp. 165–181. In Dutch with English summary.) Discussion of the action of the ear, and the way in which musical pitch is perceived.

534.78 : 621.395.61/.62 **323**

The Design of Speech Communication Systems.—L. L. Beranek. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1947, Vol. 35, No. 9, pp. 880–890.) " A method is presented for calculating the ability of a communication system to transmit speech intelligibly in the presence of noise."

621.395.61/.62 **324**

Proposed Method of rating Microphones and Loudspeakers for Systems Use.—F. F. Romanow & M. S. Hawley. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1947, Vol. 35, No. 9, pp. 953–960.) The ratings are based on the ratios (in db) of the input, output and/or available powers. The overall sound rating of a system consisting of a microphone, input coupling network, amplifier, output coupling network and loudspeaker is obtained by addition of the individual ratings.

621.395.623 **325**

Insertion Effects and Transfer Coefficients of Electroacoustic Systems.—R. Stadlin. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st Aug. & 1st Oct. 1947, Vol. 25, Nos. 4 & 5, pp. 133–143 & 187–194. In German.)

621.395.623.75 : 518.4 **326**

The Design of Acoustic Exponential Horns.—(*Electronic Engng*, Sept. 1947, Vol. 19, No. 235, pp. 286–287.) Graphs from which the dimensions of horns of square or circular cross-section may be determined for a given cut-off frequency.

621.395.623.8 + 621.395.97 **327**

Music Transmission System, with Individual Programme Selection, for Hospitals, Sanatoria, Hotels and Apartment Houses.—E. Beutler. (*Tech, Mitt. schweiz. Telegr.-TelephVerw.*, 1st Oct. 1947. Vol. 25, No. 5, pp. 194–199. In German.)

621.395.625.2 + 621.396.621 + 621.395.623.8 **328**

Portable Recorder-Player.—J. G. Karnath. (*Radio Craft*, Aug. 1947, Vol. 18, No. 11, pp. 20–21 . . 65.) A combined recording unit, record player, radio receiver and public address system. Records can be cut at either $33\frac{1}{3}$ or 78 r.p.m. and all recordings may be monitored by a volume-level indicator on the control panel. Full circuit details are given.

621.395.625.3 **329**

Magnetic Tape Recorder for Movies and Radio.—R. H. Ranger. (*Electronics*, Oct. 1947, Vol. 20, No. 10, pp. 99–103.) Response is flat within 4 db from 32 c/s to 9.6 kc/s. Circuit diagrams are included and design considerations discussed. A device simplifying editing of the recording is also described. See also 20 of January.

AERIALS AND TRANSMISSION LINES

621.315.212 **330**

Broad-Band Noncontacting Short Circuits for Coaxial Lines : Part 1 — TEM-Mode Characteristics.—W. H. Huggins. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1947, Vol. 35, No. 9, pp. 906–913.) Discussion of the design of an S-type non-contact plunger which will present an effective short-circuit to the TEM mode in a circular coaxial line over a frequency range of 3 to 1 or more. Equations showing the relation between the power loss and the physical shape of the plunger are derived and their application to a practical design is demonstrated.

621.315.212 **331**

The Capacity per Unit Length and Characteristic Impedance of Coaxial Cables with One Slightly Non-Circular Conductor.—P. Parzen. (*J. appl. Phys.*, Aug. 1947, Vol. 18, No. 8, pp. 774–776.)

621.392.029.64 + 621.317.763 + 621.396.616 **332**

The Transverse Electric Modes in Coaxial Cavities.—R. A. Kirkman & M. Kline. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1947, Vol. 35, No. 9, pp. 931–935.) Discussion on 888 of 1946.

621.392.029.64 **333**

The Propagation of Damped $H_{0,m}$ Waves near the Limiting Frequency.—A. Käch. (*Helv. phys. Acta*, 4th Aug. 1947, Vol. 20, No. 3, pp. 341–356. In German.) Calculations of propagation in hollow metal conductors give incorrect results if losses in the tube walls are not taken into account. Formulae are derived, for tubes of rectangular cross-section, which have general application and include a formula for the damping at the limiting frequency. Above and below this frequency the expressions agree with those given by other authors. See also 1328 of May (Kuhn).

621.392.029.64 **334**

Slow Transverse Magnetic Waves in Cylindrical Guides.—G. G. Bruck & E. R. Wicher. (*J. appl. Phys.*, Aug. 1947, Vol. 18, No. 8, pp. 766–769.) Because of the complex shapes given to waveguide walls by devices incorporated to reduce the phase velocity, calculations of the field pattern are inexact and complicated.

These calculations become easy and exact if, for theoretical purposes, the well-known equivalence of true and simulated dielectrics in producing a slow field is used.

Lining the guide walls with a natural dielectric might also prove to be a useful practical method of reducing the phase velocity.

621.392.029.64 : 621.315.68 **335**

Design of Simple Broad-Band Wave-Guide-to-Coaxial-Line Junctions.—S. B. Cohn. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1947, Vol. 35, No. 9, pp. 920–926.) Bandwidths greater than 2 : 1 with voltage s.w.r. of less than 2 are obtained. The theory of the designs and detailed mechanical drawings are given.

621.392.029.64 : 621.396.662.3 **336**

Lattice Filters for Decimetre Waves.—Semenov. (*See* 387.)

621.392.1 : 621.3.012.2 **337**

Transmission-Line Calculations : Use of Impedance Circle Diagrams.—W. C. Vaughan. (*Wireless Engr*, Nov. 1947, Vol. 24, No. 290, pp. 314–322.) A simplified approach for the benefit of engineers with limited mathematical experience and mainly practical needs. Both the Cartesian and polar forms of circle diagram are considered. Proofs of constructions used are indicated ; these assume little more than a knowledge of elementary geometry. A comprehensive account of circle diagrams was noted in 1031 of 1945 (Jackson & Huxley).

621.392.2 : 538.56 **338**

On the Electromagnetic Theory of the Lecher Line and Some Related Problems.—J. Oswald. (*Onde élect.*, Aug./Sept. 1947, Vol. 27, Nos. 245/246, pp. 330–340.) The problems of the Lecher line and the coaxial cable are identical and can be treated similarly. The only difference comes from the fact that for the Lecher line it is not possible to find a proper wave corresponding to a transverse electric or transverse magnetic solution. These waves of higher order do exist, however, as in the coaxial cable, but they are complex and do not constitute natural solutions of the type $F(x)G(y) \exp j(\omega t - \gamma z)$. For the coaxial cable, these higher order waves are of the type $J_n(K_r) \cos n\theta \exp j(\omega t - \gamma z)$.

On the other hand, the ordinary solution of type TEM is very simple and is conveniently treated by using the natural coordinates obtained by means of two systems of orthogonal circles. This system of coordinates is useful for all problems of electromagnetism where the limiting surfaces are circles, or arcs of circles, of the same system. Some examples of such problems are discussed, including the propagation along a cable with inner and outer conductors not concentric, and the radiation of a split cylinder.

If, as seems logical, the problem of the Lecher line is treated as a particular case of the general problem of guided waves, the line equations and constants, and the propagation constant, are obtained directly from the conditions at the limits, thus showing the close connection which exists between these quantities and the e.m. field.

621.392.43 : 621.317.3 **339**

Precision Measurement of Impedance Mismatches in Waveguide.—Pomeroy. (*See* 468.)

621.396.67 **340**

An Electromagnetic Radiation Formula.—G. Goudet. (*Onde élect.*, Aug./Sept. 1947, Vol. 27, Nos. 245/246, pp. 313–317.) Asymptotic development of the formulae of Kottler gives a radiation formula which enables the effect produced at great distances by an aerial to be determined easily if the field distribution on a surface surrounding the aerial is known. The formula is particularly useful for cm λ aerials, horns, dielectric and slot aerials, etc. The formula also has applications in optical diffraction.

621.396.67 **341**

Recent Theories of the Aerial.—É. Roubine. (*Rev. tech. Comp. franç. Thomson-Houston*, July 1947, No. 8, pp. 5–45.) Reprint of a series of articles in *Onde élect.* See 2676 of 1947 and back references.

621.396.67 **342**

Circularly Polarized Antennas.—W. Sichak & S. Milazzo. (*Elect. Commun.*, June 1947, Vol. 24, No. 2, p. 273.) Summary of I.R.E. Convention paper. A formula is derived which gives the variation in received voltage as an elliptically polarized aerial is rotated in a plane transverse to the direction of propagation of an incident elliptically polarized wave. If elliptically polarized aerials are used, some signal will always be obtained, but two cases are noted in which there will be no signal with a circularly polarized aerial. Some methods of obtaining circular polarization are discussed. Experimental results confirm the theory.

621.396.67 **343**

Radiating Slit Systems.—J. N. Feld. (*C. R. Acad. Sci. U.R.S.S.*, 10th Sept. 1946, Vol. 53, No. 7, pp. 615–618. In English.) Continuation of a paper on radiation through narrow slits in systems with axial symmetry, published in *C. R. Acad. Sci. U.R.S.S.*, 1946, Vol. 51, No. 2. Here the potential difference between the edges of the slit is variable, and the slit is cut in the surface of a thin perfectly conducting ellipsoid of revolution. The field is excited from within by a linear conductor carrying a given current and shaped so that intense radiation through the slit occurs. Field equations are derived, and the relationship between slit aerials and the 'dual' wire aerials is briefly considered. See also 2548 of 1946 and 1335 of 1947 (Booker).

621.396.67 : 621.396.97 **344**

The Broadcast Antenna.—H. P. Williams. (*J. Brit. Instn Radio Engrs*, July/Aug. 1947, Vol. 7, No. 4, pp. 140–155. Discussion, pp. 155–156.) A discussion of the factors determining the radiation along the ground from medium-wave aerials and their fade-free radius of transmission. The possibility of using slot aerials in the form of trenches or as a suspended system of wires is mentioned.

621.396.67.029.62 **345**

An Antenna that multiplies by 50.—J. A. Kmosko. (*QST*, Sept. 1947, Vol. 31, No. 9, pp. 50–53.) An array of 12 $\lambda/2$ elements fed in phase, six broadside and two high, with 12 reflectors spaced $\lambda/4$ behind the driven elements. Impedance and gain measurements are described and the beam pattern is given. The array is suitable for 144 Mc/s or higher frequencies.

621.396.671 **346**

Method of determining the Characteristic Reactance of Thin Aerials.—M. L. Levin. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1947, Vol. 11, No. 2, pp. 117–133. In Russian.)

621.396.671 : 621.396.611.33 **347**

The Matching Ranges of Transmitters.—Mourmant. (*See* 595.)

621.396.674 : 621.314.2 **348**

A Note on Coupling Transformers for Loop Antennas.—Kobilsky. (*See* 354.)

621.396.679.4† **349**

On the Efficiency of H.F. Feeders.—A. R. Vol'pert. (*Radiotekhnika, Moscow*, Sept./Oct. 1947, Vol. 2, No. 7, pp. 22–24. In Russian.)

621.392.029.64 **350**

The Principles and Practice of Wave Guides. [Book Review]—L. G. H. Huxley. Cambridge University Press, London, 328 pp., 21s. (*Wireless Engr*, Nov. 1947, Vol. 24, No. 290, p. 344.) The first of a new Cambridge series on "Modern Radio Technique", edited by J. A. Ratcliffe. It is based on courses given by the author at the Radar School of the Telecommunications Research Establishment, and provides an introduction to the great practical war-time developments in the use of waveguides.

CIRCUITS AND CIRCUIT ELEMENTS

621.3.012.2 : 621.392.1 **351**

Transmission-Line Calculations : Use of Impedance Circle Diagram.—Vaughan. (*See* 337.)

621.3.015.3 : 517.63 **352**

Oscillations and Transient Phenomena. Their Study by means of the Laplace and Cauchy Transformations.—Bouthillon. (*See* 458.)

621.3.032.24 : 621.316.722 **353**

Diode Contact Potential for Negative Bias.—H. T. Sterling. (*Electronics*, Oct. 1947, Vol. 20, No. 10, pp. 164..172.) Discusses the use of contact potential as a source of bias in high-gain audio amplifiers, in the r.f. and i.f. stages of receivers and in a.g.c. circuits.

621.314.2 : 621.396.674 **354**

A Note on Coupling Transformers for Loop Antennas.—M. J. Kobilsky. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1947, Vol. 35, No. 9, pp. 969–973.) A theoretical analysis. For optimum signal/noise ratio the loop inductance should equal the primary inductance ; general expressions for sensitivity, gain and selectivity are derived for this optimum condition assuming that circuit noise limits the sensitivity. See also 1683 of 1943 (Levy) and 2590 of 1944 (Bond).

621.316.727 **355**

Compensation of Phase Shift at Low Frequencies.—F. McGee. (*Elect. Commun.*, June 1947, Vol. 24, No. 2, pp. 270–271.) Summary of I.R.E. Convention paper. Discussion of a method for simultaneous correction of phase errors in cathode, screen and coupling circuits.

621.316.86.001.8 **356**

The Thermistor in Biological Research.—Andrew. (*See* 500.)

621.318.572 **357**

Electronic Switching.—E.M.I. Laboratories. (*Electronic Engng*, Sept. 1947, Vol. 19, No. 235, p. 282.) A sensitive cathode-coupled trigger circuit which is little affected by changes in valve characteristics, values of components or supply voltages.

621.385.832 : 621.397.6 **358**

Magnetic-Deflection Circuits for Cathode-Ray Tubes.—Schade. (*See* 574.)

621.392 + 621.385.1 : 621.396.694.012.8 **359**

Circuits and Valves in Electronics.—R. Charbonnier & J. Royer. (*Télévis. franç.*, Sept. 1947, No. 29, Supplement *Électronique*, pp. 29–32.) The first of a series of special articles. The following subjects are briefly considered :—(*a*) internal impedance of a complex system ; (*b*) transfer impedance of a quadripole ; (*c*) valve equivalent circuits ; extension to pentode ; (*d*) valve impedance.

621.396.611 **360**

On the Theory of Oscillators with a Bridge Oscillating Circuit.—K. F. Teodorchik. (*Radiotekhnika, Moscow*, Sept./Oct. 1947, Vol. 2, No. 7, pp. 3–7. In Russian.)

621.396.611.1 **361**

On the Interaction of Two Oscillators.—B. N. Gorozhankin. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1947, Vol. 11, No. 2, pp. 147–154. In Russian, with English summary.) It is shown, both theoretically and experimentally, that in the case of two identical oscillators separated by a distance great in comparison with λ, the synchronous frequency has a series of jumps when the distance between the oscillators is varied. The distance between the points where these jumps occur is approximately $\lambda/2$. With increase of separation the frequency gradually diminishes, suddenly rises, then falls again, and so on, with the reverse for decrease of separation.

621.396.611.1 **362**

Free Oscillations of a Resonant Circuit with Nonlinear Self-Inductance.—H. Miedema. (*Tijdschr. ned. Radiogenoot.*, Sept. 1947, Vol. 12, No. 5, pp. 155–163. In Dutch, with English summary.) Two particular solutions of the differential equation for such a circuit are given. The solution obtained for an undamped circuit also gives a good approximation to the true waveform with small amplitudes, and shows the relationship between frequency and amplitude.

621.396.611.21 **363**

The Series Trimming of Crystal Resonators.—M. P. Johnson. (*Electronic Engng*, Sept. 1947, Vol. 19, No. 235, pp. 281–282.) Formulae are derived for the series inductance or capacitance required for a given deviation from the crystal resonant frequency. The effect of temperature changes on the combination is considered. A particular crystal was trimmed $\pm$ 100 parts in 10^6 with little degradation of oscillator performance.

621.396.611.3 **364**

Coupled Circuits.—B. D. H. Tellegen. (*Philips Res. Rep.*, Feb. 1947, Vol. 2, No. 1, pp. 1–19.) In the determination of the frequencies and dampings of the free oscillations, the theory of coupled circuits leads to a quartic equation. For resonance curves of small relative width, the quartic can be reduced to a quadratic equation which can easily be resolved into factors, each of which determines one of the free oscillations. Coupling factors are determined for oscillatory circuits coupled by inductance, capacitance and resistance and the cases of circuits having dissimilar damping or tuning are considered.

" Systems are considered in which the circuits are coupled over an arbitrary four-terminal network which may also contain an amplifying valve."

621.396.611.3 **365**

General Calculation of a Regular Impedance Network. Application to Systems of Coupled Oscillatory Circuits.—P. Fajon. (*Rev. gén. Élect.*, Sept. 1947, Vol. 56, No. 9, pp. 377–391.) A general method is given for calculating the properties of a series of identical coupled circuits. This is applied to filters made up of (*a*) undamped and (*b*) damped circuits. Systems of coupled oscillatory circuits are also treated by a simple method, applicable to any number of circuits ; the cases of e.m. and of capacitive coupling are particularly considered.

621.396.611.4 **366**

Some Results on Cylindrical Cavity Resonators.—J. P. Kinzer & I. G. Wilson. (*Bell Syst. tech. J.*, July 1947, Vol. 26, No. 3, pp. 410–445.) " Certain hitherto unpublished theoretical results on cylindrical cavity resonators are derived. These are : an approximation formula for the total number of resonances in a circular cylinder ; conditions to yield the minimum volume circular cylinder for an assigned Q ; limitation of the frequency range of a tunable circular cylinder as set by ambiguity ; resonant frequencies of the elliptic cylinder ; resonant frequencies and Q of a coaxial resonator in its higher modes ; and a brief discussion of fins in a circular cylinder.

The essential results are condensed in a number of new tables and graphs."

A bibliography of 89 items is included.

621.396.615 : 621.316.726.078.3 **367**

The Impulse Synchronized Oscillator and Its Applications.—E. H. Hugenholtz. (*Tijdschr. ned. Radiogenoot.*, May 1947, Vol. 12, No. 3, pp. 89–110. Discussion, pp. 111–112. In Dutch, with English summary.) Description of various systems in which frequencies can be obtained with crystal stability and accuracy by using this type of oscillator. Such oscillators permit selective high-ratio frequency multiplication or division ; their principles and limitations are discussed, with particular reference to transmitters. A brief comparison is made with analogous systems.

621.396.615.029.3 **368**

A Resistance-Tuned Frequency-Modulated Oscillator for Audio-Frequency Applications.—H. S. McGaughan & C. B. Leslie. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1947, Vol. 35, No. 9, pp. 974–978.) The oscillator consists of a RC amplifier with two feedback circuits. Wide variation in frequency is obtained without excessive a.m. or harmonic distortion.

621.396.615.029.5 **369**

Practical Construction of a Beat-Frequency Oscillator.—R. Aschen & R. Zahl. (*T.S.F. pour Tous*, Sept. 1947, Vol. 23, No. 227, pp. 183–185.) Complete circuit details. Practical constructional details are given by R. Zahl in *T.S.F. pour Tous*, Oct. 1947, Vol. 23, No. 228, pp. 213–215. See also 3827 of 1947 (Aschen & Lafargue) and back references.

621.396.615.142.2 **370**

Reflex Oscillators.—Pierce & Shepherd. (*See* 611.)

621.396.615.17 : 621.314.632 **371**

Variable Time Constant.—T. Petrides. (*Electronics*, Oct. 1947, Vol. 20, No. 10, p. 138.) Crystal rectifiers as grid resistors in a multivibrator provide a variable time-constant, with a resultant square-wave output.

621.396.616 + 621.392.029.64 + 621.317.763 **372**

The Transverse Electric Modes in Coaxial Cavities.—R. A. Kirkman & M. Kline. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1947, Vol. 35, No. 9, pp. 931–935.) Discussion on 888 of 1946.

621.396/.397].645 **373**

Bandwidth and Speed of Build-Up as Performance Criteria for Pulse and Television Amplifiers.—D. G. Tucker. (*J. Instn elect. Engrs*, Part I, Aug. 1947, Vol. 94, No. 80, pp. 382–383.) Summary of 3062 of 1947.

621.396.645 : 518.4 **374**

A Method of Graphically Analyzing Cathode-Degenerated Amplifier Stages.—E. M. Lonsdale & W. F. Main. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1947, Vol. 35, No. 9, pp. 981–984.) The method is based on the use of a curve relating grid-to-ground potential to the resulting anode current, taking into account the effects of the voltage drops across cathode and anode resistors, but neglecting reactive effects.

621.396.645 : 621.396.615 **375**

The Cathode-Follower V.F.O.—W. M. Scherer. (*CQ*, Sept. 1947, Vol. 3, No. 9, pp. 15–18..84.) Combines crystal stability with easy frequency adjustment. Full circuit and constructional details and component ratings are given.

621.396.645 : 621.396.621 **376**

Intermediate-Frequency Amplifiers for Frequency-Modulation Receivers.—Adams. (*See* 527.)

621.396.645.029.42/.52 **377**

General Purpose Portable Amplifier.—C. R. Smitley. (*Electronics*, Oct. 1947, Vol. 20, No. 10, pp. 150..160.) Voltage gain can be 20 db or 40 db, and is flat to within 0.5 db over the frequency range 1–100 kc/s. Equivalent noise input level is at least 90 db below 1 V. The amplifier is operated from a 115-V a.c. line. The cathode follower can be connected to input or output. Full circuit details are given.

621.396.645.029.62 **378**

Broad-Band Very-High-Frequency Amplifiers.—A. M. Levine & M. G. Hollabaugh. (*Elect. Commun.*, June 1947, Vol. 24, No. 2, pp. 269–270.) Summary of I.R.E. Convention paper. For another summary see 3479 of 1947.

621.396.645.029.64 **379**

On the Theory of U.H.F. Amplifiers.—V. I. Siforov. (*Radiotekhnika, Moscow*, July/Aug. 1947, Vol. 2, No. 6, pp. 3–21. In Russian.) A theory of single and multi-stage amplifiers is developed in which the valves and the intervalve circuits are treated as active and passive 4-terminal networks respectively. Primary, secondary and characteristic parameters of a valve are introduced and the relationship between them is investigated. From the knowledge of these parameters the maximum amplification factor of a multi-stage amplifier can be determined and various elements of the system coordinated. General design formulae for obtaining maximum amplification with pentodes, grounded-grid triodes and other types of valves are derived and the conditions necessary for the absence of parasitic oscillations in a multi-stage amplifier are established.

621.396.645.35 **380**

High Gain D.C. Amplifier.—W. G. Shepard. (*Electronics*, Oct. 1947, Vol. 20, No. 10, pp. 138..182.) Circuit diagrams and component ratings are given. Stages are directly coupled; each has a separate power supply. The circuit has low drift, frequency response is flat to 50 kc/s, and phase shift negligible to 20 kc/s.

621.396.645.35 **381**

D.C. Amplifier for Low-Level Signals.—C. B. Aiken & W. C. Welz. (*Electronics*, Oct. 1947, Vol. 20, No. 10, pp. 124–128, 130.) To amplify signals below 1 μV the circuit noise level is reduced by the use of input impedances not exceeding 20 Ω, bandwidths of only a few cycles/sec and averaging rectifiers.

621.396.645.371 **382**

Video-Frequency Negative-Feedback Amplifiers.—M. G. Hollabaugh, J. A. Rado & A. M. Levine. (*Elect. Commun.*, June 1947, Vol. 24, No. 2, pp. 272–273.) Summary of I.R.E. Convention paper. For another summary see 3483 of 1947; see also 3517 of 1939 (Wheeler).

621.396.645.371 : 621-526 **383**

Impedances in the Amplifier with Counter-Reaction.—P. M. Prache. (*Bull. Soc. franç. Élect.*, Sept. 1947, Vol. 7, No. 73, pp. 515–528.) The amplifier with counter-reaction is treated as a servomechanism. The conditions for optimum operation of such amplifiers are determined theoretically.

621.396.662.3 **384**

Insertion Loss and Effective Phase Shift in Composite Filters at Cut-Off Frequencies.—V. Belevitch. (*Elect. Commun.*, June 1947, Vol. 24, No. 2, pp. 192–194.) Formulae are derived for the insertion loss in decibels and for the effective phase shift in radians at cut-off frequency for both low-pass and band-pass filters. The usual methods of estimating insertion losses fail at the cut-off frequencies; by these derived formulae, however, total losses are obtained by direct calculation.

621.396.662.3 **385**

Infinite-Rejection Filters.—A. M. Stone & J. L. Lawson. (*J. appl. Phys.*, Aug. 1947, Vol. 18, No. 8, pp. 691–703.) Analyses of several types of bridged-T filter structures show that they can be developed into the symmetrical lattice form, which is itself equivalent to the usual 4-arm bridge.

An expression is derived relating the circuit constants and frequency of the filter and the ratio of the output power passed by the filter to the power in the absence of the filter. In theory it is possible to obtain infinite attenuation at a given frequency while retaining essentially the same bandwidth as that for the uncompensated filter. Certain bridged-T filter structures may be adapted to meet the requirements of distributed parameter circuits, such as u.h.f. lines and u.h.f. resonant cavities. Their usefulness is discussed.

A model has been constructed which has a bandwidth of $\frac{1}{2}$ Mc/s at 3 000 Mc/s with an attenuation at resonant frequency of over 70 db, compared with 20 db for a similar uncompensated filter. The distortion produced by a u.h.f. filter of this type, in otherwise rectangular pulses of short duration, has been investigated both theoretically and experimentally, and curves are presented which show the resultant waveform as a function of the tuning of the filter.

621.396.662.3 **386**

Optimum Resistive Terminations for Single-Section Constant-K Ladder-Type Filters.—L. J. Giacoletto. (*RCA Rev.*, Sept. 1947, Vol. 8, No. 3, pp. 460–479.) " The operation of a single non-dissipative section of a ladder-type constant-K filter terminated in a resistance is considered. It is found that depending upon the value of the terminating resistance in proportion to a filter-design parameter, different filter characteristics are obtained. Optimum values for the resistive termination are determined for different operating characteristics and different filter sections. It is found that the T-filter section has somewhat better operating characteristics than the π-filter section."

621.396.662.3 : 621.392.029.64 **387**

Lattice Filters for Decimetre Waves.—V. F. Semenov. (*Radiotekhnika, Moscow,* July/Aug. 1947, Vol. 2, No. 6, pp. 44–47. In Russian.) A preliminary report on experiments with filters for H_1 waves in a cylindrical waveguide. The possibility of using such filters for tuning open-ended waveguides was also investigated.

621.396.662.3 : 621.396.611.21 **388**

Filter Crystals with Low Self-Inductance.—J. J. Vormer. (*Tijdschr. ned. Radiogenoot.*, Jan. 1947, Vol. 12, No. 1, pp. 1–6. In Dutch, with English summary.) A tenfold reduction in inductance can be obtained with a −18.5° rotated X-cut crystal by exciting a harmonic of the Y′ wave, using a series of pairs of electrodes, alternate electrodes on the two faces of the crystal being connected in parallel. The ratio of the crystal dimensions in the z and y directions must exceed unity ; a value near 1.8 minimizes spurious frequencies. Corrections, *ibid.*, March 1947, Vol. 12, No. 2, insert.

621.396.662.6 **389**

Tuning without Condensers.—F. E. Berhley. (*F.M. & Televis.*, Aug. 1947, Vol. 7, No. 8, pp. 35–37.) High sensitivity and effective static reduction are achieved by means of a tuned r.f. stage, one limiter, and a discriminator. The r.f. stage has three high-Q resonant lines but no variable capacitors.

GENERAL PHYSICS

53.08 + 621.317 **390**

Fundamentals of Measurement Technique.—J. Hartmann. (*Rev. sci., Paris,* 1st April 1947, Vol. 85, No. 3270, pp. 323–334.)

530.145.65 **391**

The Problem of the Polarization of the de Broglie Waves associated with Electrons.—J. Brenet. (*Rev. sci., Paris,* 1st April 1947, Vol. 85, No. 3270, pp. 357–359.) The phenomena of polarization of electronic waves should be examined with reference to the fundamental characteristics of the electron, essentially a simple particle in the Dirac sense, and of the photon, a particle obtained by the fusion of two corpuscles which are complementary in the Dirac sense. There appears to be no contradiction between the existence of diffraction phenomena for both photons and electrons, and the absence of polarization for electronic waves, since a state of polarization cannot be defined for a Fermi-Dirac elementary corpuscle. This will be discussed in a later paper.

534.13 : 539.21.001.572 **392**

Model to demonstrate Oscillations in a Molecule subjected to an Electric Field.—A. J. Maddock. (*J. sci. Instrum.*, Sept. 1947, Vol. 24, No. 9, pp. 230–232.) The mechanical model demonstrates dipolar, atomic and electronic relaxation oscillations occurring in the molecule, and the contribution to the total dielectric constant of each of the resulting polarizations.

535.37 **393**

The Light Emission from Fluorescent Screens irradiated by X-Rays.—Klasens. (*See* 437.)

536.33 + 536.24] : 535.37 **394**

Radiation and Heat Conduction in Light-Scattering Material.—H. C. Hamaker. (*Philips Res. Rep.*, Feb. 1947, Vol. 2, No. 1, pp. 55–57.) " On the basis of a set of simultaneous differential equations originally due to Schuster the transmission and reflection of light in light-scattering layers is discussed. Formulae previously developed by Kubelka and Munk are briefly recapitulated ; they are extended so as to describe the luminescence of fluorescent screens excited by X-rays or electron bombardment. Likewise, formulae are derived that include temperature radiation."

537.122 **395**

The Electron Jubilee.—(*Elect. Times,* 2nd Oct. 1947, Vol. 112, No. 2917, pp. 389–390.) A series of lectures arranged to celebrate J. J. Thomson's discovery of the electron. History and Early Development of the Electron, by J. A. Crowther. Electrons in Modern Theoretical Physics, by R. E. Peierls. The Electron Liberated, by C. C. Paterson. The Electron in Research, by G. Thomson. Electrons in Industry, by T. E. Allibone. See also *J. Instn elect. Engrs,* Part I, Aug. 1947, Vol. 94, No. 80, p. 339 ; *Engineer, Lond.*, 3rd Oct. 1947, Vol. 184, No. 4784, p. 315, and *Electrician,* 26th Sept. 1947, Vol. 139, No. 3615, pp. 921-923.

537.291 + 538.691] : 621.385.832 **396**

Electron Beam Deflection : Part 1 — Small-Angle Deflection Theory.—Hutter. (*See* 609.)

537.5 **397**

Discharge through Gases.—L. B. Loeb. (*Science,* 12th Sept. 1947, Vol. 106, No. 2750, pp. 229–236.) The 38th Kelvin Lecture. A historical review, with bibliography of 90 items. See also 3854 of 1947.

537.525 **398**

On the Growth, Reaction Mechanism and Stability of Low-Current, Low-Pressure Discharges.—H. Luz von Gugelberg. (*Helv. phys. Acta,* 4th Aug. 1947, Vol. 20, No. 3, pp. 307–340. In German.) Results and discussion of measurements of the development of glow discharges in He, Ar, Kr, Xe, N_2, H_2 and in Ne-Ar mixtures.

537.527 : 536.5 **399**

On the Excitation Temperature, the Gas Temperature, and the Electron Temperature in the High-Pressure Mercury Discharge.—W. Elenbaas. (*Philips Res. Rep.*, Feb. 1947, Vol. 2, No. 1, pp. 20–41.)

538.311 **400**

The Production of a Uniform Magnetic Field over a Specific Volume by means of Twin Conducting Circular Coils.—H. Craig. (*Proc. phys. Soc.*, 1st Sept. 1947, Vol. 59, No. 335, pp. 804–814.) An investigation of the uniformity of axial magnetic field attainable on the central plane between twin parallel coaxial circular coils of given diameter arranged in conjunction. The optimum coil separation and the highest degree of uniformity of the field attainable over a given circular area are derived graphically. Improved uniformity can be obtained over an annular area. Volumes of cylindrical shape are also considered, and regions of remarkably constant axial field are shown. "The best ratio of radial depth to axial length of the coils is determined, and a method is given by which the equivalent separation of parallel coils of finite cross-section can be found very exactly by means of a search coil of particular shape."

538.541 : 538.221 **401**

On the Theory of Eddy Currents in Ferromagnetic Materials.—H. B. G. Casimir. (*Philips Res. Rep.*, Feb. 1947, Vol. 2, No. 1, pp. 42–53.) The theory is developed for the limiting case where the depth of penetration d is small although the product μd is not necessarily small.

First the rigorous solution for a sphere of radius R is discussed for this limiting case. Next it is shown that the solution can be obtained from Laplace's equation with a new type of boundary condition. This boundary condition is then applied to a discussion of eddy currents in spheroids. Explicit formulae are found both for small and for very large values of $\mu d/R$.

Special attention is given to the limits for very long and very flat spheroids, respectively.

538.56 : 621.316.7.078 **402**

Radiophysics and the Theory of Automatic Control.—G. S. Gorelik. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1947, Vol. 11, No. 2, pp. 103–115. In Russian, with English summary.) A review stressing the similarity between problems on the origin of self-oscillations in radiophysics and in automatic control.

538.56 : 621.392.2 **403**

On the Electromagnetic Theory of the Lecher Line and Some Related Problems.—Oswald. (*See* 338.)

538.569.4 + 621.396.61.029.64 **404**

On the Emission of Microwaves and Their Absorption in the Air.—Ginsburg. (*See* 594.)

538.569.4.029.64 **405**

A New Electronic System for detecting Microwave Spectra.—W. Gordy & M. Kessler. (*Phys. Rev.*, 1st Oct. 1947, Vol. 72, No. 7, p. 644.) A single-crystal system using a l.f. cut-off filter and a modulation technique which allows the signal to be amplified at higher frequencies.

538.569.4.029.64 : 546.171.1 **406**

Saturation Effect in Microwave Spectrum of Ammonia.—W. V. Smith & R. L. Carter. (*Phys. Rev.*, 1st Oct. 1947, Vol. 72, No. 7, pp. 638–639.) Comment on 1399 of 1947 (Townes). The magnitude of intensity saturation of the 3,3 line here found is consistent with Townes' results, but there is no broadening of the line at low pressures. Reasons for this discrepancy are suggested. See also 3870 of 1947 (Bleaney & Penrose).

538.569.4.029.64 : 546.171.1 **407**

The Ammonia Spectrum and Line Shapes near 1.25 cm Wave-Length.—C. H. Townes. (*Bell Syst. tech. J.*, July 1947, Vol. 26, No. 3, p. 689.) Summary of 1399 of 1947, U.D.C. of which should read as above.

538.652 : 546.74 **408**

Experimental Facts concerning the Magnetostriction of Nickel.—Y. Rocard. (*Rev. sci., Paris*, 15th Feb. 1947, Vol. 85, No. 3267, pp. 195–204.) A review of data from many sources, with a short account of some applications.

538.691 **409**

Magnetic Focusing between Inclined Plane Pole-Faces.—H. O. W. Richardson. (*Proc. phys. Soc.*, 1st Sept. 1947, Vol. 59, No. 335, pp. 791–804.) The resultant magnetic field, if applied to β-ray spectroscopy, is said to give high dispersion and resolving power, together with a fair solid angle of collection Ω. With planes bevelled to become parallel at their closest parts, both lateral and longitudinal focusing should occur. Approximate calculation shows that the bevelling makes high values of Ω possible but may result in lower resolving power.

539.3 : 518.3 **410**

Nomographic Representation of the Elastic Contact Conditions between Steel Pivot and Sapphire Jewel.—G. F. Tagg. (*J. sci. Instrum.*, Sept. 1947, Vol. 24, No. 9, pp. 244–248.)

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.53 : 621.396.96 **411**

Radar Observations of Meteors.—J. S. Hey & G. S. Stewart. (*Proc. phys. Soc.*, 1st Sept. 1947, Vol. 59, No. 335, pp. 858–883.) A comprehensive account of observations made on short-duration echoes at λ 4–5 m near the E region, using British Army radar equipment. The echoes came from a height of about 95 km; the analysis indicates a close correlation between these echoes and meteors.

523.72.029.5 : 523.746 **412**

Solar Radiation at Radio Frequencies and Its Relation to Sunspots.—L. L. McCready, J. L. Pawsey & R. Payne-Scott. (*Proc. roy. Soc. A*, 12th Aug. 1947, Vol. 190, No. 1022, pp. 357–375.) Experimental studies on a frequency of 200 Mc/s are described. The radiation has characteristics similar to those of thermal radiation from the photosphere but always exceeds expected values by a factor of the order of 10^2 to 10^4. Day-to-day intensity variations show correlation with sunspot variations. Rapid intensity fluctuations or 'bursts' received simultaneously at widely spaced points are presumably solar in origin. Directional observations indicate that the radiation originates in areas in the immediate vicinity of a sunspot group. Radiation from gross electrical discharges is suggested as the cause of values of received intensity higher than could be produced by thermal radiation.

523.745 + 523.854] : 621.396.822 : 551.510.535 **413**

Solar and Terrestrial Radio Disturbances.—J. S. Hey, S. J. Parsons & J. W. Phillips. (*Nature, Lond.*, 13th Sept. 1947, Vol. 160, No. 4063, pp. 371–372.) Continuous recording of galactic radio emission for λ approximately 12 m shows a significant increase of absorption by the enhanced D-layer ionization during periods of solar activity. This effect cannot easily be distinguished if a burst of intense solar radio emission takes place simultaneously. Two examples are discussed; for one the solar radio emissions were small; for the other the absorption preceded a solar radio burst.

523.75 **414**

Electromagnetic Forces in Solar Prominences.—D. S. Evans. (*Mon. Not. R. astr. Soc.*, 1947, Vol. 106, No. 4, pp. 300–337.) The forms of solar prominences and the motion of associated knots may be explained in terms of the motion of ions in a magnetic field. In section 1 the dispersal of systems of ions under their mutual e.s. repulsion is discussed. Agreement between computed and observed velocities (of knots) is obtained by assuming the existence of a background cloud of 10^{-11} or 10^{-12} elementary charges per cm^3. In section 2 the support of prominences and of highly ionized atoms in the corona is considered in relation to the possible existence of a general e.s. field above the solar surface. Calculated space tracks of moving knots are found to be consistent with the observed forms of streamers. The forms of tornado and coronal prominences are also considered.

537.212 + 538.12] : 521.15 **415**

Stellar Electromagnetic Fields.—L. Davis, Jr. (*Phys. Rev.*, 1st Oct. 1947, Vol. 72, No. 7, pp. 632–633.) Formulae are obtained for the magnetic induction, potential and e.s. field outside a star, and rough values of these quantities for the earth, the sun, and two stars are tabulated. The limitations and implications of these formulae are discussed. See also 3891 of 1947 (Babcock) and back references.

537.591.15 **416**

Cosmic-Ray Bursts and Shower Spread under Large Thicknesses of Lead.—J. W. F. Juritz & C. B. O. Mohr. (*Proc. roy. Soc. A*, 12th Aug. 1947, Vol. 190, No. 1022, pp. 426–434.)

551.510.535 **417**

Evolution of Views on the Structure of the Ionosphere.—V. N. Kessenikh. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1947, Vol. 11, No. 2, pp. 155–163. In Russian, with English summary.) A historical survey. The necessity of extending the network of ionosphere observations is stressed.

551.510.535 : 546.21 **418**

Distribution of Molecular and Atomic Oxygen in the Upper Atmosphere.—H. Rakshit. (*Indian J. Phys.*, April 1947, Vol. 21, No. 2, pp. 57–68.) The distribution is calculated by adapting Pannekoek's method of studying the effect of solar ultraviolet radiation on atmospheric ionization; it is essentially the method of Majumdar (3121 of 1938) but Majumdar's results were based on data not corroborated by recent observations. The density of O_2 molecules decreases rapidly with height above 100 km; that of O atoms is almost zero at 80 km, increases rapidly to a maximum at 105 km and then gradually decreases.

551.510.535 : 621.396.11 **419**

The Forecasting of Ionosphere Critical Frequencies.—K. Rawer. (*Rev. sci., Paris*, 15th Feb. 1947, Vol. 85, No. 3267, pp. 234–235.) A single quantity *Q*, representing the aggregate of all the critical frequencies measured during a month, is defined by the equation

$Q = \frac{1}{24}\sum_{t=00}^{t=23} f^2(t)$, where $f(t)$ is the critical frequency of the ordinary ray at hour t. The values of *Q* vary with place, season and solar activity, but for a particular month and station they furnish an excellent means of comparison between different years. For example, the mean monthly curve for January, 1944, is derived directly from that for January, 1942, by multiplying by the square root of the ratio of the corresponding *Q* values. When the *Q* values for preceding years are known for any station, the variations corresponding to the 11-year solar cycle can be derived. This is illustrated from the data published by Washington. The method has, hitherto, only been verified experimentally for the F_2 layer. It does not appear to be applicable to the sporadic-E layer.

551.510.535 : 621.396.11 **420**

On the Reasons for a Change of Amplitude of a Single Pulse reflected from the Ionosphere.—V. D. Gusev. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1947, Vol. 11, No. 2, pp. 195–201. In Russian, with English summary.) An examination of problems related to the inhomogeneous structure of the E layer. Electron clouds whose dimensions exceed the wavelengths in question are postulated. Diffraction due to the inhomogeneities in the E layer is considered and shown to result in fading and in abnormally large values of the reflection coefficient in the case of reflection from the E or the F_2 layer. These conclusions were confirmed by continuous measurements of the reflection coefficient for vertical transmissions on frequencies of 3 and 4 Mc/s.

551.594.5 : 551.510.535 : 621.396.11 **421**

Ionospheric Perturbations in the Zone of Polar Auroras.—K. Rawer. (*Rev. sci., Paris*, 1st/15th March, 1947, Vol. 85, Nos. 3268/3269, pp. 287–288.) Discussion of absorption effects shows that frequently in the auroral zone there is an ionosphere layer, at a height of about 100 km, which is due to solar corpuscular radiation and which gives good radio reflections, often for very high frequencies. This accounts for the fact that when perturbations prevent communication by the normal frequencies and operation on lower frequencies is equally bad, it is often possible to maintain communication by using considerably higher frequencies. The development of perturbations is described and their seasonal effects are discussed.

551.594.5 : 551.510.535 : 621.396.822 **422**

Radio Echoes from the Aurora Borealis.—A. C. B. Lovell, J. A. Clegg & C. D. Ellyett. (*Nature, Lond.*, 13th Sept. 1947, Vol. 160, No. 4063, p. 372.) Recently, radio echoes were obtained at 460 km range, arising apparently from a luminescent cloud near the zenith which appeared and disappeared with the echo. Simultaneously with the appearance of the echoes, a noise level increase was observed on both 72 and 46 Mc/s over the range 450–600 km. The aurora echo was observed on 46 Mc/s but not on 72 Mc/s, and, assuming it was of the ionospheric type, its ionization density was calculated to be about 100 times the normal F-region ionization density during the night.

LOCATION AND AIDS TO NAVIGATION

621.396.663 **423**

A New British Radio Compass.—(*Electronic Engng*, Oct. 1947, Vol. 19, No. 236, p. 325.) A flattened loop aerial is housed either in a shallow blister or within the aircraft body. In automatic operation the loop, when tuned to signals from a radio beacon, sets itself in the position of minimum signal and indicators operated by a 'Desynn' servo system give the correct bearing. The loop can also be continuously rotated at a variable speed and the minimum-signal position determined aurally. Accuracy is within 1°.

621.396.93 + 621.396.663 **424**

Investigation of Errors in Spaced-Collector Direction-Finder Systems.—T. H. Clark. (*Elect. Commun.*, June 1947, Vol. 24, No. 2, pp. 199–207.) Site errors are classified but not investigated. Errors resulting from the design of one directional pair are considered for a wave arriving in the horizontal plane. These are treated mathematically and general conclusions, applicable as specific design principles, are drawn. Errors due to the combination of two directional pairs are investigated generally as are errors resulting from the use of long cables connecting the aerials to the goniometer. Finally, possible errors due to faulty alignment of the mechanical parts of the goniometer are mentioned.

621.396.932 : 621.396.96 **425**

Peacetime Radar.—B. B. Talley. (*Electronics*, Oct. 1947, Vol. 20, No. 10, pp. 113–115.) A description of radar equipment installed on river boats for navigation in fog and a survey of results obtained, illustrated by photographs of actual p.p.i. images.

621.396.933 + 621.396.96 **426**

Developments in Airline Radio and Radar Communications and Navigational Facilities : Parts 1 & 2.—H. J. Brown. (*Proc. Instn Radio Engrs, Aust.*, Aug. & Sept. 1947, Vol. 8, Nos. 8 & 9, pp. 4–9 & 4–15.) In part 1, improvements in communication between air and ground are considered. The use of ionospheric predictions for the correct choice of frequency to suit season and time of day is discussed. The results of research on precipitation static interference are considered. In part 2, radio and radar navigational facilities discussed include loran, consol and other long range systems, omnidirectional ranges of the C.A.A. type, pulse type multi-track ranges and radar distance-measuring equipment. Developments in airport control radar are also considered. The economic advantages of instrument landing systems for airlines are stressed, and possible future developments are briefly mentioned.

621.396.933 **427**

Status of V.H.F. Facilities for Aviation.—P. Caporale. (*Electronics*, Oct. 1947, Vol. 20, No. 10, pp. 90–95.) Details of the v.h.f. omnidirectional radio range now being installed throughout the U.S.A. by the C.A.A. for short-range air navigation, and operating principles of the instrument landing system and phase comparison localizer. See also 2388 of 1942 (Luck), 2655 of 1945 and back references.

621.396.933 **428**

First Tests on Navar System for Aerial Navigation and Air Traffic Control.—P. R. Adams, S. H. M. Dodington & J. A. Herbst. (*Elect. Commun.*, June 1947, Vol. 24, No. 2, pp. 263–264.) Summary of I.R.E. Convention paper. A description is given of equipment and its performance in an experimental ground and aircraft installation, assembled for preliminary tests, and of the gathering of flight data on (*a*) a pulse-type airborne distance indicator with meter presentation, (*b*) an airborne azimuth indicator with meter presentation, (*c*) a ground search radar with p.p.i., (*d*) assisted radar, using an airborne responder, with presentation on the same p.p.i.

621.396.933 **429**

Survey of Radio Navigational Aids.—R. I. Colin. (*Elect. Commun.*, June 1947, Vol. 24, No. 2, pp. 219–261.) Radio navigational aids, including the earliest, are classified into four basic types, and their fundamental principles, characteristics, and ambiguities are discussed. General air navigational requirements, including those of the radio altimeter, are mentioned, and the methods of fulfilling them described. A comprehensive list of basic radio navigational systems is given (p. 243).

621.396.933 **430**

Relations between Bandwidth, Speed of Indication, and Signal-to-Noise Ratio in Radio Navigation and Direction Finding.—H. Busignies & M. Dishal. (*Elect. Commun.*, June 1947, Vol. 24, No. 2, pp. 264–265.) Summary of I.R.E. Convention paper. For signal/noise ratios of the order of 3 : 1, the signal required for a given signal/noise ratio is proportional to the square root of the bandwidth ratio for pre-detection narrowing, and to its fourth root for post-detection narrowing. A possible new bucking detector method for reproducing signals at very low signal/impulse-noise ratios is described. The required speeds of indication for various aids to navigation are considered, and it is suggested that unnecessarily wide bandwidth is used in some of them. The navaglobe narrow-band automatic d.f. system, which has 20 c/s pass bandwidth, is described.

621.396.96 **431**

Technique and Evolution of Radar : Parts 1-4.—Demanche. (*Onde élect.*, May–Sept. 1947, Vol. 27, Nos. 242–246, pp. 173–183, 244–258, 292–304 & 341–356.) Part 1 deals with the radar equation and the choice of fundamental parameters, part 2 with transmitting and receiving apparatus, part 3 with the many different types of aerials used and part 4 with indicating apparatus and methods. To be continued.

621.396.96 **432**

The Maximum Range of a Radar Set.—K. A. Norton & A. C. Omberg. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1947, Vol. 35, No. 9, pp. 927–931.) Discussion on 2130 of 1947.

621.396.96 : 551.515.43 **433**

Radar Storm Detection.—R. Wexler & D. M. Swingle. (*Bull. Amer. met. Soc.*, April 1947, Vol. 28, No. 4, pp. 159–167. Reprint.) Basic radar theory is discussed, assuming it to be unfamiliar to meteorologists, and with particular reference to the work of Ryde (515 of 1947). The power received from rainstorms, assuming total interception of the beam by the rainstorm area, varies as $(\Sigma a^6)/R\lambda^{24}$, where a is the radius of a typical drop and R is the range. Moderate rain reflects about 10^6 times as effectively as rainless clouds. Typical attenuation values for absorption by oxygen and by water vapour, and for absorption and scattering by rain are given for λ 3.2 cm. For most storm detection purposes, λ should be 3–6 cm rather than 9–12 cm, but 10-cm radar gives stronger return signals than 3-cm equipment through heavy rain over distances in excess of about 40 km.

621.396.96 : 621.396.11 **434**

Reflection of Centimetric Electromagnetic Waves over Ground, and Diffraction Effects with Wire-Netting Screens.—Hey, Parsons & Jackson. (*See* 519.)

621.396.96 **435**

Radar System Engineering. [Book Review]—L. N. Ridenour (Ed.). McGraw-Hill, New York, 1947, 748 pp., $7.50. (*Tele-Tech*, Sept. 1947, Vol. 6, No. 9, p. 93.) The first of a series of 28 books intended to serve as a general treatise and reference work. It deals primarily with microwave pulse radar.

MATERIALS AND SUBSIDIARY TECHNIQUES

531.788.7 **436**

An Investigation on Hot-Wire Vacuum Gauges.—H. von Ubisch. (*Ark. Mat. Astr. Fys.*, 25th Sept. 1947, Vol. 34, Part 2, Section A, No. 14, 33 pp. In English.) The theory of the thermal conductivity of gases is outlined in relation to hot-wire gauges for pressures low enough to preclude convection. The influence of wire dimensions and bridge circuits on the attainment of maximum sensitivity is discussed and the results are described of experimental work on W, Mo, Ni and Pt wires of various sizes in air, H_2 and CO_2. Typical calibration curves are shown covering the pressure range 10^{-4} to 20 mm Hg; pressure changes of 10^{-5} mm Hg can be detected using a manually operated bridge at pressures below 10^{-4} mm Hg. Numerous graphical and tabulated data and a list of 46 references are given.

535.37 **437**

The Light Emission from Fluorescent Screens irradiated by X-Rays.—H. A. Klasens. (*Philips Res. Rep.*, Feb. 1947, Vol. 2, No. 1, pp. 68–78.) "Applying Schuster's theory as extended by Hamaker for the scattering and absorption of light, general equations are deduced for the amount of light emitted by fluorescent screens, irradiated by X-rays. Some commercial screens are examined to measure the 'absorption' coefficient σ of the fluorescent light. Several means to increase the brightness of a screen are discussed."

537.228.1 **438**

The Rochelle-Electric Lattice of KH_2PO_4-Type and the Behaviour of the NH_4-Rotation Transformation for $(NH_4,Tl)H_2PO_4$ Mixed Crystals.—B. Matthias, W. Merz & P. Scherrer. (*Helv. phys. Acta*, 4th Aug. 1947, Vol. 20, No. 3, pp. 273–306. In German.) An investigation of the dielectric properties of $(NH_4)H_2PO_4$ and of $(NH_4,Tl)H_2PO_4$ mixed crystals. Introduction of Tl^+ ions causes large changes of the NH_4 transformation temperature.

539.232 **439**

The Theory of the Formation of Protective Oxide Films on Metals: Part 3.—N. F. Mott. (*Trans. Faraday Soc.*, July 1947, Vol. 43, No. 298, pp. 429–434.) "A new mechanism is proposed to account for the formation on metals of oxide films which grow to a limiting thickness. According to this, electrons can pass the film easily, but ions can only penetrate it in the presence of a very strong field. This mechanism is compared with the author's previous theory based on tunnel effect; further experimental work is required to determine which is correct." For earlier parts see *ibid.*, 1939, Vol. 35, pp. 1175–1177, and 1940, Vol. 36, pp. 472–483; see also *Nature, Lond.*, 29th June 1940, Vol. 145, pp. 996–1000.

546.883 **440**

Some Applications of Tantalum in Electronics.—L. F. Yntema & R. W. Yancey. (*Beama J.*, Sept. 1947, Vol. 54, No. 123, pp. 324–325.) High melting point, strength at high temperatures, ease of working and welding, chemical inertness, ease of cleaning, and pronounced getter action make Ta particularly useful in the construction of transmitting valves.

620.193.23 + 620.197 **441**

On Rust and the Protection of Iron.—M. Ragg. (*Elektrotech. u. Maschinenb.*, Sept./Oct. 1947, Vol. 64, Nos. 9/10, pp. 150–160.) A comprehensive discussion of the subject, dealing particularly with the chemistry of passivation processes, the selection of suitable pigments for protective coatings and various special surface treatments.

620.197 : 679.5 **442**

Resin-Potting for Sub-Assemblies.—(*Tele-Tech*, Sept. 1947, Vol. 6, No. 9, p. 53.) Another account of the resin noted in 3928 of 1947.

621.315.59 **443**

Excess-Defect Semiconductor Contacts.—L. Sosnowski. (*Phys. Rev.*, 1st Oct. 1947, Vol. 72, No. 7, pp. 641–642.) These contacts have been considered theoretically with the object of explaining photovoltaic and rectifying properties of a thin layer of PbS which are not associated with a contact with metal electrodes. Fuller information is available in Admiralty Research Laboratory reports ARL/R8/E320 and ARL/R9/E320.

621.315.612 : 621.315.62 **444**

Stabilised Insulators.—G. H. Gillam. (*Elect. Times*, 11th Sept. 1947, Vol. 112, No. 2914, pp. 289–293.) A general account of the properties of semiconducting glazes. Examples are given of their use in suppressing arc breakdowns in the h.v. insulators used in power transmission lines.

621.315.612.2 **445**

Alkaline Earth Porcelains possessing Low Dielectric Loss.—M. D. Rigterink & R. O. Grisdale. (*Bell Syst. tech. J.*, July 1947, Vol. 26, No. 3, p. 688.) Summary of 3550 of 1947.

621.315.612.4.011.5 **446**

Effect of Field Strength on Dielectric Properties of Barium Strontium Titanate.—H. L. Donley. (*RCA Rev.*, Sept. 1947, Vol. 8, No. 3, pp. 539–553.) For high dielectric constant ceramics, as for ferromagnetic materials, the variation of dielectric flux density with field strength shows saturation effects. There is also a critical or Curie temperature above which dielectric constant varies linearly with field strength. The dependence of dielectric properties on field strength is shown graphically for three different mixtures of $BaTiO_3$ and $SrTiO_3$. The results suggest the use of these materials as non-linear circuit elements; their use in a frequency multiplier, frequency changer and frequency modulator is discussed. See also 3551 of 1947 (Bunting, Shelton & Creamer).

621.315.613.1 : 549.623.52 **447**

Capacitance Stability of Ruby Muscovite Mica.—W. Schick. (*J. Instn elect. Engrs*, Part I, Aug. 1947, Vol. 94, No. 80, pp. 371–376.) Short-term stability of dielectrics in general and measurements of capacitance variations of mica with temperature and air pressure are discussed. For flawless mica in the temperature range 25°C–95°C, the capacitance change is substantially linear and cyclic, and a single temperature coefficient, whose measured values are evenly spread between $+6 \times 10^{-6}$ and $+40 \times 10^{-6}$, defines the dielectric behaviour adequately. Plates with gas inclusions produce irregular and mostly very large changes of capacitance with temperature and particularly with air pressure.

621.315.616 : 549.623.5 **448**

[German] **Manufacture of Synthetic Mica.**—A. E. Link. (*Tele-Tech*, July 1947, Vol. 6, No. 7, pp. 67–68.) Abstract of article in *Chimie & Industrie, Paris*, Vol. 56, No. 1, pp. 21ff. The synthetic product, the composition of which is given, is stated to be comparable with natural mica. Large plates are obtained by controlling the cooling of the melted constituents and by applying a magnetic field. See also F.I.A.T. Final Report No. 746, entitled "Synthetic Mica Research", and B.I.O.S. Final Report No. 785, entitled "The German Mica Industry".

621.318.22 **449**

Control of Permanent-Magnet Alloy Quality.—J. D. Seaver & R. E. Anderson. (*Gen. elect. Rev.*, Oct. 1947, Vol. 50, No. 10, pp. 44–47.) Possible methods of control are discussed, and apparatus is described for testing the remanence in a predetermined magnetizing field.

621.383.4 **450**

The Photo-Conductivity of "Incomplete Phosphors".—R. Frerichs. (*Phys. Rev.*, 1st Oct. 1947, Vol. 72, No. 7, pp. 594–601.) "Synthetic single crystals of CdS, CdSe, and CdTe have been produced by the reaction of cadmium vapor with H_2S, H_2Se, and H_2Te, respectively. These 'incomplete phosphors' show no phosphorescence but strongly developed photo-conductivity. Photo-cells made from these crystals are extremely sensitive in the whole region from the infra-red down to the ultra-violet, x-rays, and gamma-rays and for corpuscular rays, alpha- and beta-rays." Two different mechanisms of photoconductivity occur, namely, the normal photoconductivity in the region of strong absorption from the blue to the ultra-violet, and the selective photoconductivity in the region of weak absorption in the visible, X-rays, and corpuscular-rays region. The phenomena observed are in general accordance with the zonal theory of phosphorescence.

621.775.7 **451**

British Advances in Powder Metallurgy.—(*Machinery, Lond.*, 11th Sept. 1947, Vol. 71, No. 1820, p. 295.) A review of Special Report No. 38 of the Iron & Steel Institute, London, containing the 28 papers presented at the symposium noted in 150 of January.

679.5 : 621.3 **452**

The Growing Importance of Plastics in the Electrical Industry.—G. Haefely. (*J. Instn elect. Engrs*, Part II, Aug. 1947, Vol. 94, No. 40, pp. 301–308. Discussion, pp. 308–312.) Full paper, of which summaries were noted in 1122 and 2161 of 1947.

535.37 **453**

Fluorescence et Phosphorescence. [Book Review]—M. Curie. Hermann, Paris, 1946, 212 pp., 350 fr. (*Nature, Lond.*, 11th Oct. 1947, Vol. 160, No. 4067, pp. 483–484.)

621.315.612 **454**

German Radio Ceramics. [Book Notice]—B.I.O.S. Final Report No. 1459. H.M. Stationery Office, London, 261 pp., 30s. Report of an investigation into the war-time activities of the Hermsdorf Schomburg Isolatoren Gesellschaft, Steatite-Magnesia, and other companies. "The data obtained covered the composition, manufacture, and properties of the various ceramic bodies, also details of the numerous types of finished radio components produced. Measuring apparatus, research and development were investigated in detail."

621.315.612.4 **455**

Experimental Low Temperature Coefficient Ceramics. Variation of Capacitance and Power Factor with Temperature. [Book Review]—A. M. Thomas. Brit. Elect. & Allied Indust. Res. Assn, Tech. Rep. L/T 170, 1946, 15 pp., 7s. (*Beama J.*, Sept. 1947, Vol. 54, No. 123, p. 321.) Ten experimental medium-permittivity ceramics were examined at frequencies in the range 800 c/s to 2.5 Mc/s and at temperatures between −31°C and 200°C. Permanent changes in dielectric properties were observed after the materials had been heated to 200°C.

MATHEMATICS

512.831 **456**

Application of the Small Parameter Method to [oscillatory] **Systems Similar to those of Sturm-Liouville.**—S. M. Rytov & M. E. Zhabotinski. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1947, Vol. 11, No. 2, pp. 135–140. In Russian, with English summary.)

512.831 : 518.5 **457**

An Experimental Determination of the Eigenvalues and Functions of Certain Operators by means of an RC Circuit.—L. A. Lyusternik & A. M. Prokhorov. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1947, Vol. 11, No. 2, pp. 141–145. In Russian, with English summary.) A method applicable to a certain class of symmetrical-A matrices, similar to the Sturm-Liouville operators and the positive symmetrical operators of Fredholm.

517.63 : 621.3.015.3 **458**

Oscillations and Transient Phenomena. Their Study by means of the Laplace and Cauchy Transformations.—L. Bouthillon. (*Ann. Radioélect.*, Oct. 1947, Vol. 2, No. 10, pp. 287–328.) Part 1 studies (*a*) mechanical systems nearly in equilibrium, (*b*) electrical networks, (*c*) gyroscopic systems, (*d*) electromechanical systems with magnetic coupling. All these systems are represented by linear differential equations with constant coefficients. The classical form of solution is recalled and the importance and diversity of its applications are shown by examples of second order equations. Continuous media are then considered, with special reference to an equation of partial derivatives of the second order, particular cases of which are the telegraphy equation, the diffusion equation and the wave equation. Part 2 discusses the application of the Laplace and Cauchy transformations. Certain definitions and results of the theory of functions of complex variables are recalled, the Laplace and Cauchy transformations defined, the conditions of the Laplace-Cauchy inversion enumerated and the principal rules given for the transformation calculations. Application is made to linear differential equations with constant coefficients, the method of integration is shown and solutions for various practical examples depending on second order equations are discussed. Rules are given for the application of the method to the integration of linear equations with partial derivatives. Two important examples considered are the diffusion equation and the wave equation. In conclusion, tables are given showing the principal rules for calculation and also a number of pairs of associated functions.

518.5 **459**

Electrical Analogue Computing : Part 4 — Pure Electronic Systems.—D. J. Mynall. (*Electronic Engng*, Sept. 1947, Vol. 19, No. 235, pp. 283–285.) Blumlein time integrator RC circuits are connected in cascade to solve linear differential equations with constant coefficients, and the solution may be shown on a c.r. tube. Schemes for multiplying and dividing voltages by means of valve amplifiers are also outlined. For earlier parts see 3563 of 1947 and 157 of January.

518.5 : 621.385 **460**

Tube Failures in ENIAC.—Michael. (*See* 601.)

518.61 : 621.396.619.13 **461**

Computation of the Solutions of $(1 + 2\epsilon\cos 2z)\,y'' + \theta y = 0$; Frequency Modulation Functions.—N. W. McLachlan. (*J. appl. Phys.*, Aug. 1947, Vol. 18, No. 8, pp. 723–731.) Carson has given an approximate solution of this equation, stable for the values of θ and ϵ encountered in radio broadcasting. Acoustic tests, using warble tones to reduce standing-wave effects, require an extended range of these parameters. Floquet's theory is applied to obtain stable solutions for such cases. The necessary formulae for accurate calculation are derived and a numerical example is given. An approximate normalization of the solutions is suggested in order to obtain standard f.m. functions.

519.271 : 539.16.08 **462**

Note on the Statistical Analysis of Counter Data.—N. Hole. (*Ark. Mat. Astr. Fys.*, 25th Sept. 1947, Vol. 34, Part 2, Section B, No. 12, 8 pp. In English.)

517.564.3(083.5) **463**

Bessel Functions : Vols. 3 and 4, Annals of the Computation Laboratory of Harvard University : Tables. [Book Review]—Harvard University Press, 1947, Vol. 3, 694 pp., $10 ; Vol. 4, 662 pp., $10. (*Tele-Tech*, Sept. 1947, Vol. 6, No. 9, pp. 93–94.) Tables of $J_0(x)$ and $J_1(x)$ in Vol. 3, and $J_2(x)$ and $J_3(x)$ in Vol. 4, computed to 18 places by means of the automatic sequence controlled calculator (461 & 787 of 1947).

518.5 **464**

Calculating Machines — Recent and Prospective Developments. [Book Review]—D. R. Hartree. Cambridge University Press, England ; MacMillan Co., New York, 1947, 40 pp., 2s. and 75c. (*Nature, Lond.*, 2nd Aug. 1947, Vol. 160, No. 4057, p. 142 : *Elect. Engng, N.Y.*, Oct. 1947, Vol. 66, No. 10, p. 1047.) Analogue and digital machines are described, with special reference to the ENIAC. See also 2480, 2481 and 3952 of 1947, and 158 of January (Burks).

MEASUREMENTS AND TEST GEAR

531.765 : 621.38 **465**

A Millisecond Chronoscope.—R. S. J. Spilsbury & A. Felton. (*J. Instn elect. Engrs*, Part II, Aug. 1947, Vol. 94, No. 40, pp. 316–322. Discussion, pp. 322–324.) Full paper, of which a summary was noted in 1137 of 1947.

621.317 + 53.08 **466**

Significance of Functional Analysis of Measurements.—H. C. Dickinson. (*Gen. elect. Rev.*, Oct. 1947, Vol. 50, No. 10, pp. 13–16.) For functional analysis, any measurement system is divided into three principal functional groups : the primary detector, the end device, and the intermediate means. Each group is further subdivided into basic elements. Measurement energy is regarded as flowing from the quantity measured through the apparatus to the end device. Specific examples are discussed.

621.317 + 53.08 **467**

Fundamentals of Measurement Technique.—Hartmann. (*See* 390.)

621.317.3 : 621.392.43 **468**

Precision Measurement of Impedance Mismatches in Waveguide.—A. F. Pomeroy. (*Bell Syst. tech. J.*, July 1947, Vol. 26, No. 3, pp. 446–459.) "A method is described for determining accurately the magnitude of the reflection coefficient caused by an impedance mismatch in waveguide by measuring the ratio between incident and reflected voltages. Reflection coefficients of any value less than 0.05 (0.86 db standing wave ratio) can be measured to an accuracy of ± 2.5%."

621.317.333.82 **469**

The Henley 1 200 000 Volt Impulse Testing Plant : Part 2 — The Impulse Generator : Part 3 — The High Speed Cathode-Ray Oscillograph.—T. R. P. Harrison. (*Distrib. Elect.*, July & Oct. 1947, Vol. 20, Nos. 167 & 168, pp. 252–255 & 278–282.)

Details of the charging unit, capacitor bank, capacitor potential divider, tripping mechanism, voltage measurement apparatus and control gear. Part 1 : 2848 of 1947.

621.317.336 **470**

The Measurement of H.F. Impedance and Applications of the Standing-Wave Indicator.—H. J. Lindenhovius. (*Tijdschr. ned. Radiogenoot.*, March 1947, Vol. 12, No. 2, pp. 65–82. In Dutch, with English summary.) A survey of different methods. For frequencies below 300 Mc/s the impedance is usually determined by its effect on a tuned circuit ; for higher frequencies it is best to use an untuned transmission line and determine the s.w.r. and the position of the voltage minimum ; a graphical method of deducing the impedance is discussed. A standing-wave indicator and its applications are described.

621.317.41 : 621.318.323.2.042.15 **471**

Determination of the Permeability of Powdered-Iron Ring Cores.—R. Schiffermüller. (*Elektrotech. u. Maschinenb.*, Nov./Dec. 1946, Vol. 63, Nos. 11/12, pp. 254–256.) A method for rapid testing. A small coil within the ring to be measured is fed from an 800-c/s source. The voltage induced in two coils outside the ring which are connected in series depends on the permeability of the ring. This voltage is amplified and applied to an indicating instrument which is calibrated to give direct readings of permeability.

621.317.44 **472**

A Sensitive Recording Magnetometer.—A. Butterworth. (*J. Instn elect. Engrs*, Part II, Aug. 1947, Vol. 94, No. 40, pp. 325–330. Discussion, pp. 330–332.) Full paper, of which a summary was noted in 1137 of 1947.

621.317.44 : 621.395.623.741 **473**

Testing Loudspeaker Magnets.—E. E. George. (*Gen. elect. Rev.*, Oct. 1947, Vol. 50, No. 10, pp. 24–26.) Details of the requirements, construction, and operation of a new, portable, vibrating tester for the rapid production testing of magnets. The specimen is temporarily magnetized and a flux-density measurement is made, under normal operating conditions, by means of a continuously vibrating search coil and associated valve voltmeter. The search coil oscillates with constant amplitude.

621.317.7 **474**

Progress in Instrument Design.—D. B. Fisk & J. M. Whittenton. (*Gen. elect. Rev.*, Oct. 1947, Vol. 50, No. 10, pp. 8–11.) An illustrated general survey. Discussion with specific examples of (*a*) improvements of basic design, (*b*) extension of usefulness by means of accessories, (*c*) modifications of basic designs to meet special needs.

621.317.7.029.64 **475**

On Certain Instruments for Measurements at Centimetre Wavelengths.—M. T. Grekhova, S. I. Averkov, D. I. Grigorash & V. I. Anikin. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1947, Vol. 11, No. 2, pp. 183–189. In Russian, with English summary.) Descriptions of (*a*) receiver-wavemeter with automodulation, (*b*) wavemeter with c.r. indicator, (*c*) voltmeter, (*d*) field-strength meter.

621.317.715.085.39 **476**

Note on ' A Simple Galvanometer with Negative Feedback '.—D. K. C. MacDonald. (*J. sci. Instrum.*, Sept. 1947, Vol. 24, No. 9, pp. 232–233.) A description of a sensitive galvanometer system employing photocell amplification and series feedback. The circuit is suitable for measurement of small potentials such as those occurring in metallic conductivity experiments. It is shown how performance equations may be derived for both the series and parallel-feedback systems. For Preston's earlier design see 3670 of 1946 and 1513 of 1947.

621.317.725 **477**

A General - Purpose Valve Voltmeter. — F. Gutmann. (*Proc. Instn Radio Engrs, Aust.*, Aug. 1947, Vol. 8, No. 8, pp. 16–20.) Requirements and desirable characteristics of such an instrument are discussed, together with the construction, operation and performance of an inexpensive instrument using a cathode-follower type probe. A balanced metering system permits the separate determination of a.c. and d.c. simultaneously present. The voltmeter can be used over a wide range of voltages and frequencies. A bibliography of 25 items is given.

621.317.725.027.7 **478**

The Design of an Ellipsoid Voltmeter for the Precision Measurement of High Alternating Voltages.—In abstract 3584 of 1947, it was stated that " the voltage between the disks is deduced with an estimated error of less than 0.3%". This should read 0.03%.

621.317.755 : [621.317.722 + 531.761 **479**

The Waveform Monitor : A Cathode-Ray Tube Equipment for the Measurement of Voltage and Time.—H. L. Mansford. (*Electronic Engng*, Sept. & Oct. 1947, Vol. 19, Nos. 235 & 236, pp. 272–275 & 328–332.) Direct and alternating potentials are measured by a null method whereby a cathode-coupled amplifier gives push-pull deflections which indicate the balance of the input potential against another potential derived from and measured by the instrument. A similar amplifier is used to magnify and calibrate any portion of a synchronized time-base. The operation of the Miller integrator and of ' long tailed pair ' circuits is also described.

621.317.755 : [621.317.722 + 531.761 **480**

A Note on the Zero Setting Circuit of the Waveform Monitor.—A. M. Spooner. (*Electronic Engng*, Oct. 1947, Vol. 19, No. 236, p. 332.) Comment on 479 above.

621.317.761 **481**

An Instrument for Short-Period Frequency Comparisons of Great Accuracy.—H. B. Law. (*J. Instn elect. Engrs*, Part I, Aug. 1947, Vol. 94, No. 80, p. 377.) Summary of 2178 of 1947.

621.317.761 : 621.318.572 **482**

Frequency Standards and Electronic Counters.—B. van Dijl. (*Tijdschr. ned. Radiogenoot.*, March 1947, Vol. 12, No. 2, pp. 37–61. Discussion, pp. 62–64. In Dutch, with English summary.) Discussion of (*a*) the generation of standard frequencies, (*b*) the measurement of their constancy, (*c*) the use of counters for such measurements, and (*d*) results obtained.

621.317.761.029.64 **483**

A Microwave Frequency Standard.—R. G. Talpey & H. Goldberg. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1947, Vol. 35, No. 9, pp. 965–969.) A stabilized 10-Mc/s quartz-crystal oscillator feeds a multiplier chain, and the voltage outputs at 20, 40, 120 and 360 Mc/s are mixed in a silicon-crystal harmonic generator with a crystal current of 30–40 mA. The output spectrum extends to at least 10 000 Mc/s; frequencies are identified by means of a coaxial-line wavemeter. Images are easily identified using a superheterodyne detector with a mid-band frequency of 0.5 Mc/s and a bandwidth of 0.6 Mc/s.

621.317.763 + 621.396.616 + 621.392.029.64 **484**

The Transverse Electric Modes in Coaxial Cavities.—R. A. Kirkman & M. Kline. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1947, Vol. 35, No. 9, pp. 931–935.) Discussion on 888 of 1946.

621.317.763.089.6 **485**

A Method for Calibrating Microwave Wavemeter.—L. E. Hunt. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1947, Vol. 35, No. 9, pp. 979–981.) A quartz-controlled oscillator and harmonic generator system is used as a frequency reference. The frequency of a calibrating oscillator, sufficiently powerful to operate the wavemeter, is continuously compared with the standard by separately heterodyning both outputs with that of a third oscillator to which a sawtooth f.m. voltage is applied. The resulting products are displayed on an oscilloscope so that frequencies can be continuously compared with an inaccuracy of less than 12 kc/s.

621.317.79 **486**

The Characteristic Recorder.—T. Kammerloher. (*Funk-Technik, Berlin*, 1947, Vol. 2, Nos. 17 & 18, pp. 6–8 & 6–7.) The recorder has two moving-coil instruments with their pivotal axes at right angles. Each coil system carries a small mirror and a beam of light is reflected in turn from each mirror, falling finally on a screen. A detailed description is given of the use of the instrument for obtaining (*a*) resonance curves of tuned circuits, and (*b*) valve characteristics.

621.317.79 : 621.396.615 **487**

Special Applications of Ultra-High-Frequency Wide-Band Sweep Generators.—J. A. Bauer. (*RCA Rev.*, Sept. 1947, Vol. 8, No. 3, pp. 564–575.) Discussion of the use of wide-band f.m. signal generators for (*a*) r.f. impedance measurements of wide-band terminal and other devices on a transmission line; (*b*) overall frequency response measurements of television receivers; (*c*) frequency measurements in the range of 250–10 000 kc/s within about 0.001%. Large savings of laboratory and factory test time have already been achieved.

621.317.79 : 621.396.712 **488**

Monitoring Equipment for Frequency-Modulation Broadcasting.—M. Silver. (*Elect. Commun.*, June 1947, Vol. 24, No. 2, p. 273.) Summary of I.R.E. Convention paper. The design and method of operation of such equipment are discussed, together with the measurements required to prove its performance. It is claimed that noise can be measured to −80 db, distortion to 0.2%, and station carrier frequency to within ± 100 c/s under full-modulation conditions with long-time stability of 1 part in 5×10^5.

621.317.79 : 621.396.822 : 621.385.1 **489**

Measurement of Valve Background Noise.—M. Chamagne & G. Guyot. (*Télévis. franç.*, Sept. 1947, No. 29, Supplement *Électronique*, pp. 36–39.) A short discussion of the origin of valve noise and a description of practical apparatus for its measurement. The method is that of Ziegler and uses a saturated diode as the comparison noise source. Measurements on EF5 and AC2 valves are shown graphically. The results for AC2 valves are in excellent agreement with those of M. J. O. Strutt.

621.317.79 : 621.396.822 : 621.385.2 **490**

How Sensitive is Your Receiver?—B. Goodman. (*QST*, Sept. 1947, Vol. 31, No. 9, pp. 13–21.) Sources of noise are discussed, noise factor is defined as the ratio of the equivalent noise power of a receiver to that of an ideal receiver, and a detailed description is given of a simple diode noise generator which has proved very useful in measurements of noise factor. The method of use is described and illustrated by results obtained during the development of a cathode-coupled preamplifier.

621.317.79.029.64 : 621.396.81 **491**

On the Thermometric Method of measuring the Field Strength of Centimetre Waves.—S. M. Rytov. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1947, Vol. 11, No. 2, pp. 191–194. In Russian, with English summary.) Means are described for increasing considerably the sensitivity of the thermometer.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

519.271 : 539.16.08 **492**

Note on the Statistical Analysis of Counter Data.—Hole. (*See* 462.)

535.61-15 : 621.317.755 : 535.33 **493**

An Infra-Red Spectroscope with Cathode-Ray Presentation.—E. F. Daly & G. B. B. M. Sutherland. (*Proc. phys. Soc.*, 1st Sept. 1947, Vol. 59, No. 335, p. 901.) Discussion on 2860 of 1947.

539.16.08 **494**

Some Properties of Counters with Beaded Wires.—S. C. Curran & E. R. Rae. (*J. sci. Instrum.*, Sept. 1947, Vol. 24, No. 9, pp. 233–238.) A description of the effect on the performance of a Geiger counter of attaching closely spaced beads on the central wire. The main result is a reduction in overall efficiency due to the production of local insensitive regions around the beads. The localization of the discharge and its variation with voltage, nature of the gas mixture, and pressure are discussed.

539.16.08 **495**

The Discharge Mechanism of Self-Quenching Geiger-Mueller Counters.—S. H. Liebson. (*Phys. Rev.*, 1st Oct. 1947, Vol. 72, No. 7, pp. 602–608.) Full paper: summary in 3982 of 1947.

539.16.08 **496**

Accurate Method of Measuring the Efficiency of Geiger-Müller Counters.—A. Rogozinski & A. Voisin. (*C. R. Acad. Sci., Paris*, 1st Sept. 1947, Vol. 225, No. 9, pp. 409–411.)

539.16.08 : 531.717.1 **497**

Beta-Ray Thickness Gage for Sheet Steel.—O. J. M. Smith. (*Electronics*, Oct. 1947, Vol. 20, No. 10, pp. 106–112.) "G-M counters and integrating circuits, responding to absorption of beta rays by steel strip moving over a radiostrontium source, measure thickness over range of 7 to 24 mils. Sheets can be sorted automatically by a mechanical gate after cutting. Accuracy is analyzed."

621.316.7.078 **498**

Theory of Automatic Control Systems.—M. A. Melvin. (*J. appl. Phys.*, Aug. 1947, Vol. 18, No. 8, pp. 704–722.)

621.316.71 : 629.12.014.6 **499**

The Use of High Permeability Materials in Magnetometers. The Application of a Saturated Core Type Magnetometer to an Automatic Steering Control.—L. D. Armstrong. (*Canad. J. Res.*, May 1947, Vol. 25, Sec. A, No. 3, pp. 124–133.) The accuracy of steering was ±½°, or better, with hunting so small as to have no noticeable effect on the ship's course.

621.316.86.001.8 **500**

The Thermistor in Biological Research.—B. L. Andrew. (*Electronic Engng*, Sept. 1947, Vol. 19, No. 235, pp. 288–289.) "Used as a resistance thermometer it has applications where there is a requirement for remote indication of temperature, small size of sensitive element and a rapid response to changes of temperature." Suitable circuits are described and their operation is discussed. See also 3044 of 1947 (Rosenberg).

621.317.083.7 **501**

Problems of Telemetry and Their Solutions.—W. Boesch. (*Rev. gén. Élect.*, Sept. 1947, Vol. 56, No. 9, pp. 355–368.) Part 1 discusses the requirements of, and errors in, telemetry systems. Part 2 describes briefly a wide range of devices, from simple voltmeter circuits to selsyns, frequency variation or compensation systems, and many pulse systems. A synoptic table of all the methods noted is given and its use is illustrated by practical examples.

621.317.083.7 : 551.46.018.1 **502**

Telemetering Fathometer.—E. F. Kiernan. (*Electronics*, Oct. 1947, Vol. 20, No. 10, pp. 96–98.) For continuous depth indications beneath a remote-controlled pilotless ship. Frequencies near 8 and 70 Mc/s are used.

621.317.39 : 620.178.3 **503**

A Twelve-Channel Recorder for Use with Resistance Strain Gauges.—A. Watson. (*J. sci. Instrum.*, Sept. 1947, Vol. 24, No. 9, pp. 239–242.) For investigating stresses on a ship's hull. See also 3217 of 1947 (Cogman).

621.365.92 : 641.3 **504**

U.H.F. Heating of Frozen Foods.—P. W. Morse & H. E. Revercomb. (*Electronics*, Oct. 1947, Vol. 20, No. 10, pp. 85–89.) Discussion of problems encountered in developing 1 050-Mc/s c.w. magnetron oscillator equipment for thawing and heating pre-cooked frozen food.

621.365.92.001.8 **505**

An Electronic Development of Growing Importance: Dielectric Heating and Its Many Practical Applications.—G. R. Cooper. (*Overseas Engr*, July 1947, Vol. 20, No. 237, pp. 370–372.) A brief survey of the practical applications, with special reference to curing thermosetting glue bonds in the woodworking industry.

621.384 **506**

Travelling-Wave Linear Accelerator for Electrons.—D. W. Fry, R. B. R.-S.-Harvie, L. B. Mullett & W. Walkinshaw. (*Nature, Lond.*, 13th Sept. 1947, Vol. 160, No. 4063, pp. 351–353.) A new application of the principle used in the Sloan & Lawrence positive ion accelerator (*Phys. Rev.*, 1st Dec. 1931, Vol. 38, No. 11, pp. 2021–2032) is possible now that radar magnetrons can give high peak power in pulse operation at short wavelengths.

The 0.5-MeV accelerator described uses a wavelength of 10 cm. A travelling wave is set up in a 40-cm length of circular waveguide with deep corrugations whose depth determines the phase velocity. Experimental and theoretical results agree closely. The accelerator would be working at optimum efficiency if the waveguide were extended to 20 m.

With an applied r.f. power of 1 MW, energy spectrum measurements show a maximum peak pulse beam current of 36 mA at an energy very close to 540 kV (the designed value) with a width of 65 keV between half-amplitude points. A very large proportion of the injected electrons were trapped by the wave and formed into stable bunches.

621.384.6 **507**

Theory of the Proton Synchrotron.—J. S. Gooden, H. H. Jensen & J. L. Symonds. (*Proc. phys. Soc.*, 1st Sept. 1947, Vol. 59, No. 335, p. 901.) Corrections to 209 of January.

621.384.6 : 621.313.322 **508**

Power Supply for the 100 000 000-Volt Betatron.—F. L. Kaestle. (*Elect. World, N.Y.*, 30th Aug. 1947, Vol. 128, No. 9, pp. 42–44.) Details of the synchronous-synchronous motor-generator set, 3-phase to single-phase, with amplidyne voltage-regulating equipment and reduced-voltage starting control, delivering the required 24 000-kVA excitation from a bank of 24-kV, 1 000-A capacitors.

621.384.6(43) **509**

European Induction Accelerators.—R. Wideröe. (*J. appl. Phys.*, Aug. 1947, Vol. 18, No. 8, p. 783.) Comment on 2527 of 1947 (Kaiser).

621.385.833 **510**

Coaxial Electron Lenses.—J. W. Dungey & C. R. Hull. (*Proc. phys. Soc.*, 1st Sept. 1947, Vol. 59, No. 335, pp. 828–843.) A detailed mathematical account of these lenses, which contain a central conductor surrounded by a number of annular electrodes. The e.s. fields in these lenses can be calculated by superimposing fields of a certain simple type. This type of field, which is tabulated, corresponds to a 'one-element' coaxial lens with an annular electrode in the form of a perforated disk with rounded edges, preceded and followed by cylindrical guard rings. At least two such lenses are required to correct the spherical aberration inherent in the ordinary electron microscope, and a three-element correcting lens is better. These systems are analysed in detail. The workmanship involved in their construction must be of the highest order. Careful focusing is required because of the small focal depth, which, however, suggests the possibility of examining objects in depth with an accuracy of the order of 100 Å.

621.385.833 **511**

The Use of the Fluxball Method in the Measurement of the Axial Distribution of the Magnetic Field in Electron Microscope Lenses.—K. I. Williamson. (*J. sci. Instrum.*, Sept. 1947, Vol. 24, No. 9, pp. 242–243.) A ballistic method in which a specially wound coil is withdrawn suddenly, by an elastic suspension, from a known position in the lens to a field-free region. The method is suitable for measurement of magnetic fields with rapid space variations.

PROPAGATION OF WAVES

621.396.11 + 621.396.65.029.64 **512**

Microwave Communication Link.—Lamont, Robertshaw & Hammerton. (*See* 549.)

621.396.11 **513**

The Propagation of Radio Waves and the Inhomogeneity of the Atmosphere.—H. Bremmer. (*Tijdschr. ned. Radiogenoot.*, Jan. 1947, Vol. 12, No. 1, pp. 7–29. In Dutch, with English summary.) The theory of propagation of radio waves which suffer reflection at the ionosphere is considered from the point of view of geometrical optics, allowing for vertical atmospheric inhomogeneities. The condition for superrefraction is derived, and the behaviour of short waves is compared with that of long waves.

621.396.11 : 551.510.535 **514**

Calculation of the Field of a Space Wave.—K. Rawer. (*Rev. sci., Paris*, 1st April 1947, Vol. 85, No. 3270, pp. 361–362.) The basic principle of the method described for calculating the field at a great distance from a s.w. transmitter consists in determining separately the fields corresponding to the different possible paths and then combining them. The results indicate that the inverse square law is only followed for a short distance from the transmitter and that beyond this distance the value of the field is greater than would be given by the inverse square law. The effects of the various ionosphere layers are briefly discussed.

621.396.11 : 551.510.535 **515**

The Prediction of Optimum Working Frequencies for Short Wave Radio Circuits.—H. Stanesby & G. H. M. Gleadle. (*P. O. elect. Engrs' J.*, July 1947, Vol. 40, Part 2, pp. 76–79.) A short general discussion of optimum frequencies and an account of methods for their determination.

621.396.11 : 551.510.535 **516**

The Forecasting of Ionosphere Critical Frequencies.—Rawer. (*See* 419.)

621.396.11 : 551.510.535 **517**

On the Reasons for a Change of Amplitude of a Single Pulse reflected from the Ionosphere.—Gusev. (*See* 420.)

621.396.11 : 551.594.5 : 551.510.535 **518**

Ionospheric Perturbations in the Zone of Polar Auroras.—Rawer. (*See* 421.)

621.396.11 : 621.396.96 **519**

Reflexion of Centimetric Electromagnetic Waves over Ground, and Diffraction Effects with Wire-Netting Screens.—J. S. Hey, S. J. Parsons & F. Jackson. (*Proc. phys. Soc.*, 1st Sept. 1947, Vol. 59, No. 335, pp. 847–857.) An account of a simple technique for determining the echo signal strength pattern in the vertical plane for a British Army G.L.III radar equipment, operating at λ 10.7 cm, on natural sites both with and without artificial screening. The transmitter radiated 1-μs pulses at a peak power of 200 kW. Separate transmitter and receiver paraboloids with apertures 1.22 m in diameter, mounted adjacently with foci 3.6 m above the ground, could be traversed together in bearing or elevation. Vertical polarization was used and the reflector was a papier mâché sphere 0.6 m in diameter, metallized with sprayed zinc and supported by a balloon. The range of the reflector was 2 500–3 000 m and height varied from ground level to 500 m.

The measurements obtained over different natural sites were in good agreement with theory. The effect of wire-netting screens of 22 S.W.G. galvanized iron wire and 1.4-cm mesh, erected about 50 m from the equipment, was measured and shown to be in agreement with simple diffraction theory.

621.396.11.029.6 **520**

Ten-Meter Propagation by Rebound Scattering.—D. W. Heightman. (*CQ*, Sept. 1947, Vol. 3, No. 9, pp. 19–21 . . 87.) Fairly weak but reasonably consistent signals can be received on λ 10 m from stations 50–500 miles away, well within the skip zone and too far away for the ground wave to be audible. Both receiving and transmitting aerials must point in approximately the same direction. It is suggested that these signals are not due to 'long' or 'short' scatter, but to direct scattering from the F_2 layer.

621.396.11.029.64 **521**

3- and 9- Centimeter Propagation in Low Ocean Ducts.—M. Katzin, R. W. Bauchman & W. Binnian. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1947, Vol. 35, No. 9, pp. 891–905.) Description of one-way radio propagation measurements between ship and shore, coupled with meteorological measurements, made in the British West Indies area. Persistent low-level ducts (20–50 ft in height), whose strength and height appeared to depend on wind speed, were found. Various aerial-height combinations were used and very effective trapping was found on λ 3 cm for heights between 6 ft and 15 ft. On λ 9 cm the trapping was only partial. Attenuation rates on λ 9 cm averaged 0.85 db/nautical mile up to about 80 miles and 0.2 db/mile beyond, while the rate on λ 3 cm was 0.45 db/mile for all ranges up to 150 miles. Radar measurements on λ 3 cm gave similar results. See also 2900 of 1947 (Pekeris).

621.396.81 + 621.396.72 **522**

2½-Watt F.M. Transmitter permits City-Wide Coverage.—(*See* 554.)

RECEPTION

621.396.621 **523**

The Reception of Short Waves with a Standard Commercial Receiver.—G. Trestchenkoff. (*Radio franç.*, Sept. 1947, pp. 5–11.) The lack of sensitivity of some receivers on short waves is discussed and found to be frequently due to one or more of the following causes :—(*a*) poor gain for m.f. ; (*b*) poor gain of h.f. tuned circuits ; (*c*) inefficient frequency changer ; (*d*) grid current. Means are suggested for eliminating these sources of trouble.

621.396.621 + 621.396.69] : 06.064 London **524**

Radio Exhibition [Olympia, London].—W. E. Miller. (*Elect. Rev., Lond.*, 10th Oct. 1947, Vol. 141, No. 3646, pp. 543–546.) A short account of some of the principal features. See also 617 below.

621.396.621 : 621.396.619.11 **525**

The Design of a Synchrodyne Receiver : Part 1—Design Principles.—D. G. Tucker. (*Electronic Engng*, Aug. 1947, Vol. 19, No. 234, pp. 241–245.) Design principles, together with all the information required for the construction of a receiver of this type. A locked oscillator is used for demodulation. See also 2364 of 1947 and 526 below.

621.396.621 : 621.396.619.11 **526**

The Design of a Synchrodyne Receiver : Part 2 — Some Suitable Designs.—D. G. Tucker & J. F. Ridgway. (*Electronic Engng*, Sept. 1947, Vol. 19, No. 235, pp. 276–277.) Three circuits are given : (*a*) a cathode-coupled Cowan ring demodulator for low sensitivities (discussed more fully in 525 above) ; (*b*) two r.f. stages and a ring demodulator for high sensitivities ; (*c*) a very simple receiver using a triode-hexode for demodulation.

621.396.621 : 621.396.645 **527**

Intermediate-Frequency Amplifiers for Frequency-Modulation Receivers.—J. J. Adams. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1947, Vol. 35, No. 9, pp. 960–964.) Voltage feedbacks must be reduced to a minimum to obtain good results in mass production without stagger tuning. Selectivity and stability formulae, stabilizing methods, and methods of aligning double-tuned transformers are discussed.

621.396.621.54 : 518.4 **528**

Superheterodyne Tracking Charts.—Y. P. Yu. (*Tele-Tech*, Sept. 1947, Vol. 6, No. 9, pp. 46–47 . . 108.) Charts for determining the values of inductances and capacitances in permeability-tuned and capacitance-tuned systems.

621.396.822 : 621.317.79 : 621.385.2 **529**

How Sensitive is Your Receiver?—Goodman. (*See* 490.)

621.396.828 : 621.319.74 : 629.135 **530**

Electrostatic Dischargers for Aircraft.—W. C. Hall. (*J. appl. Phys.*, Aug. 1947, Vol. 18, No. 8, pp. 759–765.) Methods using high-mobility gaseous ions are preferred to those using low-mobility charge carriers such as water spray. The discharger invented and developed at the Naval Research Laboratory is described. See also 2916 of 1947 (Beach).

621.396.828 : 621.396.619.16 **531**

Noise-Suppression Characteristics of Pulse Modulation.—S. Moskowitz & D. D. Grieg. (*Elect. Commun.*, June 1947, Vol. 24, No. 2, pp. 271–272.) Summary of I.R.E. Convention paper. Discussion of the manner in which noise may enter a pulse-time modulation system and of the effectiveness of various methods used in its elimination. Another summary noted in 3269 of 1947.

621.396.828 : 621.397.62 **532**

Interference with Television Broadcasting.—Grammer. (*See* 579.)

621.396.828 : 621.397.62 **533**

Electrical Interference Suppression in Television Receivers.—Flach. (*See* 580.)

621.396.822 **534**

Radio Noise. Radio Research Special Report No. 15. [Book Notice]—H. A. Thomas & R. E. Burgess. H. M. Stationery Office, London, 1947, 3s. 4d. (*Elect. Rev., Lond.*, 10th Oct. 1947, Vol. 141, No. 3646, p. 546 : *Govt Publ., Lond.*, Sept. 1947, p. 9.) A survey of existing information about, and data on, radio noise within the 1–30-Mc/s frequency band. Issued by the Department of Scientific and Industrial Research as a foundation for investigations now being started in various parts of the world.

STATIONS AND COMMUNICATION SYSTEMS

621.396/.397(47) **535**

Broadcasting and Television Methods in the Soviet Republics.—A. Huth. (*Tele-Tech*, Sept. 1947, Vol. 6, No. 9, pp. 30–33 . . 114.) The development, scope and methods are discussed, and the 1946–50 Five Year Plan is outlined. Rediffusion methods, serving individual listeners and public places, are used extensively. High power medium- and long-wave transmitters predominate ; lists of these are included. A television centre was opened in Moscow in 1938.

621.396.1 **536**

Narrow-Band F.M. Authorized.—(*Electronics*, Oct. 1947, Vol. 20, No. 10, pp. 146, 240.) For class A amateurs, the frequency bands 3.85–3.90 Mc/s and 14.20–14.25 Mc/s have been authorized for f.m. R/T on an experimental basis. Frequencies in the ranges 28.5–29 Mc/s and 51.5–52 Mc/s may also be used at any licensed amateur radio station.

621.396.1 **537**

Space Diversity Reception at Super-High Frequencies.—G. H. Huber. (*Bell Lab. Rec.*, Sept. 1947, Vol. 25, No. 9, pp. 337–341.) Describes the use in California of vertically spaced aerials for diversity reception of pulse-position modulated 4 350–4 800-Mc/s signals. 510 miles were covered in optical stages of from 24 to 170 miles, some over land and some over water. Results indicate that the complementary vertical space diversity method is of great value in improving performance of super-high-frequency relay paths operating over sea or smooth land.

621.396.1 : 621.397.828 **538**

Engineering Problems involved in TV Interference.—A. Francis. (*Tele-Tech*, Sept. 1947, Vol. 6, No. 9, pp. 42–45 . . 109.) Mutual interference makes it impracticable for other services in the U.S. to share television channels. It is recommended that the television frequency spectrum should be extended and the frequencies allotted to different services reallocated.

621.396.332 **539**

Tape Relay System for Radiotelegraph Operation.—S. Sparks & R. G. Kreer. (*RCA Rev.*, Sept. 1947, Vol. 8, No. 3, pp. 393–426.) Telegrams are received in a form suitable for immediate retransmission, so that service is quickened and operating costs and the possibilities of human error are reduced.

621.396.41 : 621.396.97 **540**

Ultra-High-Frequency Multiplex Broadcasting System.—A. G. Kandoian & A. M. Levine. (*Elect. Commun.*, June 1947, Vol. 24, No. 2, p. 268.) Summary of I.R.E. Convention paper. Pulse time modulation is used. A highly directive receiving aerial is permanently focused on the transmitter. The required programme is chosen by push-button selection of simple timing circuits.

621.396.41 : 621.396.97 : 621.396.619.16 **541**

6-Channel Multiplex Equipment for Broadcasting.—Chamagne & Guyot. (*Onde élect.*, Aug./Sept. 1947, Vol. 27, Nos. 245/246, pp. 318–329.) A short discussion of the principles of pulse modulation with some details of apparatus using pulse duration modulation. This apparatus combines high-fidelity reproduction with low distortion and background noise.

621.396.41.029.64 : 621.395.43 **542**

Multiplex Microwave Radio applied to Telephone Systems.—T. H. Clark. (*Elect. Commun.*, June 1947, Vol. 24, No. 2, pp. 265–266.) Summary of I.R.E. Convention paper. Two systems are described. One has a single wide-band channel capable of transmitting the frequency spectrum presented by a conventional frequency-division-multiplex carrier system. In the other a number of telephone conversations are applied as voice bands to time-division-multiplexing equipment.

621.396.619.11/.13 **543**

Amplitude and Frequency Modulation.—A. A. McKenzie. (*Wireless Engr*, Nov. 1947, Vol. 24, No. 290, p. 332.) Criticism of 3660 of 1947 (Nicholson). For a direct comparison between an a.m. and a f.m. system, reference is made to 3528 of 1939 (Weir). A short paper by C. M. Jansky, Jr, entitled "The Demonstrated Potentialities of Frequency Modulation Broadcasting on Very High Frequencies", prepared for the International Telecommunications Conference at Atlantic City on 6th Aug. 1947, also summarizes the advantages inherent in f.m. broadcasting.

621.396.619.16 **544**

Pulse Count Modulation System.—D. D. Greig. (*Tele-Tech*, Sept. 1947, Vol. 6, No. 9, pp. 48–52 . . 98.) Transmission is effected by dividing the amplitude of the modulating signal into finite levels, determining the instantaneous amplitude at short time intervals and then representing each amplitude level by different combinations of constant-amplitude pulses. The demodulated signal is discontinuous, but intelligible speech can be obtained with seven modulation levels.

Time-division multiplex may be used. Relaying does not increase noise since the pulses are regenerated. Oscillograms of signals, and block schematic diagrams are given, together with tables of the distortion obtained and the number of pulses required per signal for different numbers of levels and typical pulse repetition rates.

621.396.619.16 : 621.395.43 **545**

Telephony by Pulse Code Modulation.—W. M. Goodall. (*Bell Syst. tech. J.*, July 1947, Vol. 26, No. 3, pp. 395–409.) Another pulse code modulation system was noted in 258 of January (Batcher).

621.396.65 + 621.396.7] (494) **546**

High-Altitude [radio] **Stations and Links.**—W. Gerber & F. Tank. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st Oct. 1947, Vol. 25, No. 5, pp. 177–186. In German.) The mountainous character of Switzerland offers distinct possibilities for the use of cm-, dm- and m-wave technique for communication purposes, including telephony to alpine huts and other relatively inaccessible stations, broadcasting, facsimile transmission and television. A station at Chasseral, 1 608 m above sea level, provides coverage over a wide area by line-of-sight links using a multichannel R/T system.

621.396.65 : 523.3 **547**

Considerations of Moon Relay Communications.—D. D. Grieg, S. Metzger & R. Waer. (*Elect. Commun.*, June 1947, Vol. 24, No. 2, pp. 266–267.) Summary of I.R.E. Convention paper. Discussion of the possibilities of the moon as a passive repeater for radio links. The Doppler frequency shift due to the relative motion of earth and moon, the effect of cosmic noise, and the moon's radio reflecting properties are considered. See also 106 of 1947 (Clarke).

621.396.65 : 621.396.41 : 621.396.619.16 **548**

Pulse-Time-Modulated Multiplex Radio Relay System — Radio-Frequency Equipment.—D. D. Grieg & H. Gallay. (*Elect. Commun.*, June 1947, Vol. 24, No. 2, pp. 141–158.) Useful microwave transmission is limited to the band 1 000–7 000 Mc/s. At these frequencies, high frequency-stability and i.f. amplification are necessary, and transmission lines are inefficient. Many problems are solved by the use of pulse-time modulation.

The four-stage receiver in the experimental New York/Trenton link has a gain of 80 db, bandwidth of 8 Mc/s and an image rejection ratio of 72 db. The transmitter operates at frequencies between 1 200 and 1 300 Mc/s, incorporates a 2C43 valve and can modulate at frequencies up to 3.5 Mc/s.

Tower heights should be 100–200 ft and repeater stations 20–30 miles apart. Power supplies may be derived from the wind. Details of the performance of the link are given. For a description of the terminal equipment see 1213 of 1947 (Grieg & Levine).

621.396.65.029.64 + 621.396.11 **549**

Microwave Communication Link.—H. R. L. Lamont, R. G. Robertshaw & T. G. Hammerton. (*Wireless Engr*, Nov. 1947, Vol. 24, No. 290, pp. 323–332.) A single-channel duplex 3.2-cm R/T system is described. A single parabolic mirror is used as aerial for both transmitted and received signals, which are separated in a waveguide system. The transmitter is a klystron oscillator of about 75 mW output. The superheterodyne receiver is fitted with a.f.c. and a.g.c. The equipment has been in operation for over a year; it was installed to provide R/T communication over one of the 57-mile oversea optical paths used in the propagation experiments described in 518 of 1947 (Megaw). Variations in signal strength occur mainly in fine weather, within a range of ± 10 db, but the a.g.c. makes them unnoticeable. Occasional very deep rapid fading was also observed at intervals over a period of perhaps an hour. Operation over other optical paths up to 70 miles long is also described.

621.396.65.029.64 **550**

Microwave Radio Relay Systems.—E. Labin. (*Elect. Commun.*, June 1947, Vol. 24, No. 2, pp. 131–140.) The effects of topography, of atmospheric refraction and of absorption on line-of-sight microwave propagation are discussed; a 30-db overall margin in power should be sufficient to make failure improbable. Both frequency selection and time division methods are available for multiplex transmission, but each requires a large bandwidth. The determination of the transmitter power required for such systems is discussed; powers of the order of several watts are necessary to allow for fading. Details of a Paris/Montmorency experimental link and of a New York/Trenton experimental link are given; see also 548 above and 551 below, 3283 of 1947 (Gerlach) and back references.

621.396.65.029.64 **551**

Paris-Montmorency 3 000-Megacycle Frequency-Modulation Radio Link.—A. G. Clavier & G. Phélizon. (*Elect. Commun.*, June 1947, Vol. 24, No. 2, pp. 159–169.) English version of 540 of 1947.

621.396.7 **552**

Tangier Radio Relay Station.—(*Elect. Commun.*, June 1947, Vol. 24, No. 2, p. 208.) The station provides a through teletype service between New York and Moscow, and 24-hour service between New York and certain European and Asiatic cities. The reliability of the relayed circuits is high because they avoid direct routes which are very long, or which pass near to the north magnetic pole and are subject to severe ionospheric disturbances.

621.396.712 **553**

The Allouis (France) Short-Wave Broadcasting Centre.—M. Matricon. (*J. Brit. Instn Radio Engrs*, Sept. 1947, Vol. 7, No. 5, pp. 184–193.) A description of the transmitting equipment. There are two separate transmitters with independent power supply. Each transmitter consists of three h.f. chains, any two of which can be connected at will to two independent l.f. chains so that four programmes may be transmitted simultaneously.

Each l.f. chain consists of line amplifier, equalizers and limiters, input amplifier, sub-modulator and modulator. The h.f. chains comprise crystal oscillators (stability 1 in 10^6), frequency doublers, 1-kW amplifier, 10-kW amplifier and power stage using two continuously evacuated demountable valves. The h.f. power output is not less than 100 kW. Twelve rhombic aerials are provided; connections to the transmitters are made from a control desk by servomechanism.

621.396.72 + 621.396.81 **554**

2½-Watt F.M. Transmitter permits City-Wide Coverage.—(*Tele-Tech*, Sept. 1947, Vol. 6, No. 9, pp. 34–35.) Block diagram and performance of an 88-Mc/s General Electric phasitron-based transmitter installed at Syracuse University, U.S.A. A coverage radius of 7 miles for a field strength of 50 μV/m at a height of 30 ft was obtained with a horizontal circular loop transmitting aerial at a height of 100 ft. Calculated and measured field strengths are compared; discrepancies are attributed to the hilly terrain.

621.396.931 **555**

The Problems of Radio Communication with Moving Trains.—G. H. Leversedge. (*J. Brit. Instn Radio Engrs*, July/Aug. 1947, Vol. 7, No. 4, pp. 157–163. Discussion, pp. 163–164.) Brief survey of operational requirements for speech transmission and difficulties met in practice, with particular reference to British railways. Results of recent tests on the London and North Eastern Railway are summarized.

621.396.931.029.62 **556**

Mobile Frequency-Modulation 30-44-Megacycle Equipment.—R. B. Hoffman & E. W. Markow. (*Elect. Commun.*, June 1947, Vol. 24, No. 2, pp. 170–178.) The system "is characterized by simplicity of operation, small size of mobile equipment, improved receiver squelch circuit, low power drain for mobile equipment during stand-by, plug-in arrangement of units for ease of replacement and servicing, and a self-contained selective calling system." See also 3665 of 1947.

621.396.97 **557**

U.N. Telecommunications Facilities.—J. Peterson. (*Tele-Tech*, Sept. 1947, Vol. 6, No. 9, pp. 24–28 .. 102.) A $6,000,000 plan to provide world-wide coverage for United Nations programmes by linking them to national and local broadcast systems.

621.396.619.13 **558**

Frequency Modulation Engineering. [Book Review]—C. E. Tibbs. Chapman & Hall, London, 310 pp., 28s. (*Elect. Rev., Lond.*, 21st Nov. 1947, Vol. 141, No. 3652, p. 771.) "The book . . . can be recommended to all requiring information about frequency modulation."

SUBSIDIARY APPARATUS

621.3.016.3.029.64 **559**

Power Loads at Very- and Ultra-High Frequencies.—A. G. Kandoian & R. A. Felsenheld. (*Elect. Commun.*, June 1947, Vol. 24, No. 2, pp. 267–268.) Summary of I.R.E. Convention paper. The following new designs of power load are described (*a*) transmission-line: a coaxial line with circulating water used as a dielectric and cooling agent; (*b*) radiator-type: an aerial or radiator enclosed in a tank of water; (*c*) resonant-cavity type: a $\lambda/4$ coaxial resonant circuit of low Q.

621.314.65 : 621.396.71 **560**

The Application of High-Voltage Steel-Tank Mercury-Arc Rectifiers to Broadcast Transmitters.—P. A. T. Bevan. (*J. Instn elect. Engrs*, Part II, Aug. 1947, Vol. 94, No. 40, pp. 299–300.) Discussion on 206 of 1946.

621.314.65 : 621.396.71 **561**

High-Voltage Steel-Tank Mercury-Arc Rectifier Equipments for Radio Transmitters.—J. C. Read. (*J. Instn elect. Engrs*, Part II, Aug. 1947, Vol. 94, No. 40, pp. 299–300.) Discussion on 205 of 1946.

621.316.54 + 621.318.5 **562**

Glass-Sealed Switches and Relays.—C. G. McCormick. (*Bell Lab. Rec.*, Sept. 1947, Vol. 25, No. 9, pp. 342–345.) The dry-reed and mercury-contact types of switch are discussed and performance figures given. They are designed to withstand extreme climates.

621.316.722 **563**

Optimum Parameter for Gas Tube Voltage Regulators.—W. R. Berg. (*Electronics*, Oct. 1947, Vol. 20, No. 10, pp. 136, 138.) Determination of values of the circuit constants for maximum regulation for gas-tube voltage regulators with linear current/voltage characteristic.

621.396.68 : 621.316.722.1 **564**

The Stabilization of Power Supplies in Radio Technique.—J. Moline. (*Radio franç.*, Sept. 1947, pp. 16–19.) Discussion of various regulation systems of the variable series or shunt impedance type, with practical examples.

621.396.69 **565**

The Reconstruction of Leafield Long Wave Radio Masts.—J. P. Harding & J. F. Harmon. (*P.O. elect. Engrs' J.*, April & July 1947, Vol. 40, Parts 1 & 2, pp. 1–7 & 63–68.) The considerations which led to the decision to reconstruct in reinforced concrete the ten 305-ft tubular steel masts at Leafield radio station are discussed and the design problems which this entailed are considered. An account is given of the organization and constructional methods employed on site.

TELEVISION AND PHOTOTELEGRAPHY

621.396/.397(47) **566**

Broadcasting and Television Methods in the Soviet Republics.—Huth. (*See* 535.)

621.397.3 **567**

Finch Facsimile-in-Color Process.—(*Tele-Tech*, Sept. 1947, Vol. 6, No. 9, p. 29.) The picture to be transmitted in colour is scanned with red, blue, yellow and white light. At the receiver the picture is dotted on a linear raster by red, blue, yellow and black pencils mounted in a turret rotating in synchronism with the scanner. A solenoid-operated device presses the correctly coloured pencil against the paper at the correct moment. Picture definition is 100 lines/inch and the speed of reproduction 4 square inches/minute ($\frac{1}{2}$-inch travel of 8-inch roll). See also *Electronics*, Oct. 1947, Vol. 20, No. 10, pp. 104–105.

621.397.3 **568**

Colorimetry in Television.—W. H. Cherry. (*RCA Rev.*, Sept. 1947, Vol. 8, No. 3, pp. 427–459.) Colorimetrically exact reproduction of colour in simultaneous television is now possible. The basic concepts and relations of trichromatic colorimetry are developed. See also 3297 of 1947 and 572 below.

621.397.5 **569**

American Television.—M. Lorach. (*Télévis. franç.*, June–Oct. 1947, Nos. 26–30, pp. 2–6, 2–5, 8, 6–10, 6–8 & 8–11, 18.) A general description of the principal features of the various systems, with some details of aerials, cable and radio links, relay stations, special transmitting valves, service areas, and the R.C.A. and C.B.S. systems of colour television.

621.397.5 : 535.37 : 621.385.832 **570**

Application of I.C.I. Color System to Development of All-Sulfide White Television Screen.—A. E. Hardy. (*RCA Rev.*, Sept. 1947, Vol. 8, No. 3, pp. 554–563.) Full paper; summary noted in 4051 of 1947.

621.397.5 : 621.396.65 **571**

Television Radio Links.—(*Electrician*, 27th June 1947, Vol. 138, No. 3602, p. 1769.) Some details of the equipment installed on Danbury Hill, near Chelmsford, for relaying the television transmissions from Alexandra Palace, $31\frac{1}{2}$ miles away, to Great Bromley, near Colchester, 24 miles beyond Danbury Hill. For another account see *Electronic Engng*, Aug. 1947, Vol. 19, No. 234, p. 240.

621.397.6 **572**

An Experimental Simultaneous Color-Television System.—R. D. Kell: G. C. Sziklai, R. C. Ballard & A. C. Schroeder: K. R. Wendt, G. L. Fredendall & A. C. Schroeder. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1947, Vol. 35, No. 9, pp. 861–875.) The paper describes a system in which the three primary colour pictures are transmitted simultaneously. The standard scanning speeds are used so that a monochrome picture can be received on existing receivers.

Pickup equipments for both films and live subjects are described. The film is scanned by means of a flying-spot kinescope. The transmitted light is divided into the three primary colours by dichroic mirrors and the three light beams are converted into video signals by multiplier photocells. The live-subject equipment is similar in principle, the light reflected from the subject being picked up by a bank of red-, green- and blue-filtered photocells. The development of the kinescope, the video amplifiers, correction circuits and the construction of the equipment are described.

For the transmission of the three video signals a sub-carrier system is used, the red sub-carrier frequency being 8.25 Mc/s and the blue 6.25 Mc/s. The sound is inserted between the green and the blue channels on a 4.5-Mc/s sub-carrier. The reproduction system consists of a three-gun kinescope which produces three separate images on different areas of the tube face. The images are filtered to produce the three colours and combined by a system of mirrors and a lens to form a registered colour image. Details of the kinescope and the associated circuits are given.

621.397.6 **573**

Magnetic Deflection of Kinescopes.—K. Schlesinger. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1947, Vol. 35, No. 8, pp. 813–821.) The energy of the deflecting field is calculated for various deflecting angles and beam voltages. The efficiency of sweep generators, having the preferred positive rate of change of anode current, is discussed. Transients during the retrace and their elimination are considered; a special damping method by secondary emission within the output valve is described. Some basic forms of sweep distortion are discussed and means for their correction are indicated. Finally, a sweep circuit of improved efficiency is described. Flyback energy is rectified and the resulting direct-current power added to the anode power supply. See also 3220 of 1946 (Sziklai), 272 of 1947 (Cocking) and back references, and 3305 of 1947 (Friend).

621.397.6 : 621.385.832 **574**

Magnetic-Deflection Circuits for Cathode-Ray Tubes.—O. H. Schade. (*RCA Rev.*, Sept. 1947, Vol. 8, No. 3, pp. 506–538.) In principle, an ideal cyclic system for deflecting an electron beam requires only wattless power. A practical system may be based on the fact that the inherent capacitance associated with a deflecting circuit will form a tuned circuit with the deflecting coil. This will rapidly reverse the field in the deflecting coil when the energizing potential is removed. An electronic switch can be used to control this potential. The graphical representation of the circuit resistance as a load line in the anode characteristics of electron tubes functioning as an electronic switch, furnishes an accurate means of obtaining operating conditions and specifications for the design of practical tubes and circuits.

" A substantial fraction of the circulating power in certain deflecting systems can be recovered as d.c. power output from the circuit and, by the use of specific transformation ratios, may be recirculated through the system."

621.397.61 **575**

Power Stage of a Television Transmitter.—M. R. Labadie. (*Télévis. franç.*, June & July 1947, Nos. 26 & 27, pp. 10–12 & 12–15.) A general treatment of the inverse amplifier with cathode excitation, and discussion of neutrodyning, modulation, anode circuit, choice of valves and results obtained with the Eiffel Tower transmitter.

621.397.62 **576**

R.C.A. Television Receiver, ' Popular ' Type.—(*Radio franç.*, Sept. 1947, pp. 23–25.) A short general description, with detailed circuit diagram.

621.397.62 **577**

A Modern High-Quality Television Receiver for the Home Constructor.—W. I. Flach & N. H. Bentley. (*Electronic Engng*, Oct. 1947, Vol. 19, No. 236, pp. 320–321.) Photographs and a few details of a receiver which is fully described in a booklet entitled " A Modern Home-Built Televisor ", published by *Electronic Engng.*

621.397.62 : 535.88 **578**

Optical Design of Philco Television Projection Receiver.—W. F. Bradley & E. Traub. (*Tele-Tech*, Sept. 1947, Vol. 6, No. 9, pp. 36–40 . . 105.) Supplementing preliminary details noted in 2963 of 1947. For analysis of wide aperture optics see also 3587 of 1945 (Epstein & Maloff).

621.397.62 : 621.396.828 **579**

Interference with Television Broadcasting.—G. Grammer. (*QST*, Sept. 1947, Vol. 31, No. 9, pp. 24–30.) Amateur interference with television is principally, though not entirely, a question of transmitter harmonics. The various circuits of television receivers are discussed with a view to finding out what frequencies are likely to cause interference. Details are given of experiments carried out by the Central Jersey Radio Club to trace the causes of individual cases of interference and, if possible, to find remedies. See also 254 of January (Seybold).

621.397.62 : 621.396.828 **580**

Electrical Interference Suppression in Television Receivers.—W. I. Flach. (*Electronic Engng*, Oct. 1947, Vol. 19, No. 236, pp. 326–327.) Tests on a receiver near a main road showed that frequently the sound was completely swamped, while about half the picture was obliterated. Considerable improvement was effected, for sound, by the use of diode limiters similar to those used in Pye post-war and in Murphy receivers. Video interference was reduced by limiting to the peak-white level. Suitable circuits are given.

621.397.645 : 621.397.62 **581**

Wide-Band Amplification, by Wobbulation of the Carrier Wave, in the ' Ontra ' Receiver.—(*Radio franç.*, Sept. 1947, pp. 21–22.) The values of R and C for the oscillator of the frequency changer are so chosen that the valve functions as a blocked oscillator. In addition, the capacitance of the tuned circuit is reduced to a minimum, so that the circuit is practically tuned by the valve input capacitance. Under these conditions a sawtooth wobbulation of the frequency is automatically obtained ; it is thus possible to use i.f. tuned circuits of high impedance, of the order of 20 000 Ω for circuits tuned to 15 Mc/s. The ' Ontra ' video receiver uses only three valves, an ECH3 as oscillator and frequency changer, a high-slope i.f. valve and an EBL1 as detector and video amplifier.

621.397.7 **582**

Plan for a Television Station.—N. Q. Lawrence. (*Electronic Engng*, Oct. 1947, Vol. 19, No. 236, pp. 322–324.) A survey of the general requirements for flexible and smooth working, with a description of a model of a station in which five studios, of different sizes, are conveniently arranged round a central control tower. Use of the basement for artists' accommodation, with direct access to each studio, permits free movement of performers and operational staff. Audiences are restricted to the first floor.

621.397.828 : 621.396.1 **583**

Engineering Problems involved in TV Interference.—Francis. (*See* 538.)

621.397.5 **584**

Television Techniques. [Book Review]—H. Bettinger. Harper Bros, New York, 1947, 237 pp., $5.00. (*Electronics*, Oct. 1947, Vol. 20, No. 10, pp. 260–261.) " Based on the production experience at WRGB, Schenectady. . . . Pictorial composition and continuity, visual and audio techniques, television script writing, producing and directing are covered in the text."

TRANSMISSION

621.391.63 : 621.325.53 **585**

The Concentrated-Arc Lamp in a Light-Beam Communication System.—W. D. Buckingham, C. R. Deibert & R. V. Morgenstern. (*Elect. Engng, N.Y.*, Oct. 1947, Vol. 66, No. 10, pp. 975–979.) For another account see 3691 of 1947 (Buckingham & Deibert).

621.396.61 **586**

The Practice of Frequency Modulation.—R. Gosmand. (*Télévis. franç.*, Sept. 1947, No. 29, pp. 14–16.) Description, with detailed circuit diagrams, of a transmitter with stabilized frequency and either a.m. or f.m.

621.396.61.029.56/.58 **587**

2, 6 and 10 [metres] **with Crystal Control.**—J. Millen. (*QST*, Sept. 1947, Vol. 31, No. 9, pp. 66–70.) Circuit and operational details of a 10-m transmitter with an input of about 100 W. Operation on 6 m makes use of a second crystal. For 2-m operation a frequency tripler circuit is used with the 6-m oscillator.

621.396.61.029.58 **588**

Medium Power — Living-Room Style.—L. T. Waggoner. (*QST*, Sept. 1947, Vol. 31, No. 9, pp. 37–46.) Circuit and constructional details of a 350-W transmitter for c.w. or telephony, housed in a metal cabinet 36¾ inches × 21½ inches × 15 inches. Circuits are conventional and 1 250-V and 600-V power supplies are included.

621.396.61.029.58 **589**

Revamping the 150-B for 14-Mc/s Operation.—J. M. Murray. (*QST*, Sept. 1947, Vol. 31, No. 9, pp. 22–23, 120.) Details of alterations required to increase the maximum frequency from 12 to 14 Mc/s.

621.396.61.029.62 **590**

25 Watts H.F. on 60 Mc/s.—L. Liot. (*Télévis. franç.*, June & July 1947, Nos. 26 & 27, Supplement *Électronique*, pp. 1–4 & 10–12.) A transmitter using $\lambda/4$ resonant bifilar lines for grid and anode tuning in the oscillator, the valve for which is a QQE04/20. The modulation and feed circuits and aerial coupling are described in detail.

621.396.61.029.62 **591**

F.M. Broadcast Transmitters using Phasitron Modulation.—L. O. Krause. (*F. M. & Televis.*, June 1947, Vol. 7, No. 6, pp. 31–36..54.) Design and circuit details for a series of commercial power amplifiers which may be combined to give outputs of 1, 3, 10, 25 and 50 kW in the frequency band 88–100 Mc/s. The basic 250-W f.m. exciter was described in 277 of 1947 and the theory of operation of the phasitron valve was given in 1405 and 2767 of 1946.

621.396.61.029.62 **592**

KSBR'S 50-kW [100.5-Mc/s] **High-Band F.M. Transmitter.**—R. L. Norton, B. O. Ballou & R. H. Chamberlin. (*Electronics*, Oct. 1947, Vol. 20, No. 10, pp. 80–84.) Detailed description with drawings, photographs and a block diagram. Special tank circuits are used, together with a new multi-unit thoriated-filament triode, Type 3X12500A3.

621.396.61.029.62 : 621.396.931 **593**

A One Kilowatt V.H.F. Frequency Modulated Transmitter.—J. B. L. Foot. (*J. Brit. Instn Radio Engrs*, Sept. 1947, Vol. 7, No. 5, pp. 195–203. Discussion, pp. 203–204.) For high fidelity broadcasting.

621.396.61.029.64 + 538.569.4 **594**

On the Emission of Microwaves and Their Absorption in the Air.—V. L. Ginsburg. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1947, Vol. 11, No. 2, pp. 165–182. In Russian, with English summary.) An analysis of certain new methods of generating waves with wavelength <1 cm, with particular reference to emission by a relativistic electron and by an electron moving near a dielectric.

621.396.611.33 : 621.396.671 **595**

The Matching Ranges of Transmitters.—P. Mourmant. (*Radio franç.*, Sept. 1947, pp. 12–15.) A discussion of the problem of matching a transmitter to an aerial by means of an interposed device. It is shown that in general matching devices must include at least two variable elements. When only two variable elements A and B are included, there are normally two pairs of values of A and B which satisfy the matching condition. To increase the matching range it is often desirable to use more than two variable elements. See also 1958 of 1947 (Glazer & Familier).

621.396.615.17 **596**

A 5-kW Pulse Generator.—L. Liot. (*Télévis. franç.*, Sept. 1947, No. 29, Supplement *Électronique*, pp. 33–35.) Uses an EE50 for the pulse circuit, an EL6 for the amplifier and an 807 for the modulator. An oscillator using two 955 valves and fed from this modulator gives a peak h.f. power of about 300 W at a frequency of 375 Mc/s.

621.396.619.13 : 518.61 **597**

Computation of the Solutions of $(1 \quad 2\epsilon\cos 2z)y'' + \theta y = 0$; Frequency Modulation Functions.—McLachlan. (*See* 461.)

621.396.645 : 621.396.61 **598**

Characteristics of the Quadriline Amplifier.—J. R. Day & M. H. Jennings. (*F.M. & Televis.*, Aug. 1947, Vol. 7, No. 8, pp. 43–46.) A push-pull parallel arrangement of four 4-1000A internal anode tetrodes, using 4-wire balanced transmission lines as input and output circuits. These circuits are open at one end and closed at the other by short-circuits between adjacent line elements. The symmetry of the arrangement makes the external field very small, so that operation is substantially independent of surrounding screens and little useful power is lost by radiation or external dissipation.

VALVES AND THERMIONICS

621.314.67 **599**

The Rating of Small- and Medium-Power Thermionic Rectifiers.—H. T. Ramsay. (*J. Instn elect. Engrs*, Part III, July 1947, Vol. 94, No. 30, pp. 260–274.) It is suggested that the rating of such rectifiers could be improved by specifying recommended values of the ratio of the source to the load resistance (R_s/R_0), and the product of the load resistance and the admittance of the input capacitor (ωCR_0). This specification ensures that full-load operation is always accompanied by a particular set of waveforms. Tables are given from which the full-load performance of a valve may be evaluated from its basic properties. Fractional-load conditions are investigated, and performance curves indicating the best use of the valve at a particular fraction of its maximum output are deduced.

621.383.5 **600**

Electromotive Force and Internal Resistance of Blocking Layer Photo Elements.—A. E. Sandström. (*Ark. Mat. Astr. Fys.*, 25th Sept. 1947, Vol. 34, Part 2, Section B, No. 9, 7 pp. In English.) The equivalent network of such elements is assumed to contain an e.m.f. E of internal resistance R_b, shunted by the barrier-layer resistance R_b', while an external resistance R_e represents that of the electrodes and semiconductor. Typical experimental values for R_b, R_b' and R_e are given and it is shown that E is always higher than the potential difference between the electrodes for zero current.

621.385 : 518.5 **601**

Tube Failures in ENIAC.—F. R. Michael. (*Electronics,* Oct. 1947, Vol. 20, No. 10, pp. 116–119.) Analysis of the causes of 644 valve failures occurring in the 18 800-valve ENIAC (158 of January) during one year of operation. The five major causes of failure were found to be (*a*) open heater wire, (*b*) damaged oxide-cathode coating, (*c*) internal leads and supports dangerously close, (*d*) open electrode spot welds, and (*e*) burned-open shorts. Each is discussed with photographic examples. Experiments show no difference in the rate of failure between valves to which full heater voltage was applied at once and those receiving a gradual application of voltage. These results could be used to improve the odds against valve failure in industrial service.

621.385.029.63/.64 **602**

Kinetic Theory of the Exchange of Energy between an Electron Beam and an Electromagnetic Wave.—A. Doehler & W. Kleen. (*Ann. Radioélect.,* July 1947, Vol. 2, No. 9, pp. 232–242.) The alternating electron current resulting from the interaction of the electron beam and the electric vector of the travelling wave is first determined. From consideration of the transfer of energy, three waves are found to exist, travelling in the same direction as the electron beam ; the amplitude of one wave is strongly amplified and this wave predominates after traversing a sufficiently great path. The power gain is calculated in a homogeneous waveguide with and without attenuation. Discussion of the particular cases of a plane or cylindrical waveguide partially filled with a dielectric shows that the kinetic theory and the deductions from it are consistent with Maxwell's equations.

621.385.1 **603**

The Valves to be used in the [French] **Receivers of Tomorrow.**—G. Giniaux. (*T.S.F. pour Tous,* Sept. 1947, Vol. 23, No. 227, pp. 177–179.) Future French valves should embody recent improvements in construction introduced both in France and in other countries. The advantages of the all-glass technique and 'Rimlock' base are discussed briefly.

621.385.1 : 621.317.79 : 621.396.822 **604**

Measurement of Valve Background Noise.—Chamagne & Guyot. (*See* 489.)

621.385.1 : 621.396.694.012.8 + 621.392 **605**

Circuits and Valves in Electronics.—Charbonnier & Royer. (*See* 359.)

621.385.1.032.216 **606**

Oxide Cathodes. The Effect of the Coating-Core Interface on Conductivity and Emission.—D. A. Wright. (*Proc. roy. Soc. A,* 12th Aug. 1947, Vol. 190, No. 1022, pp. 394–417.) A potential barrier occurring at the interface between oxide and metal leads to a rectifier action restricting the flow of electrons from metal to coating. In a well-activated coating this restriction determines the thermionic emission that can be drawn from it and accounts for the rapid decay of emission immediately after the application of anode voltage.

621.385.1.032.216 : 535.215.9 **607**

Effect of Light on the Behaviour of Oxide Cathodes.—J. Debiesse & R. Champeix. (*C. R. Acad. Sci., Paris,* 1st Sept. 1947, Vol. 225, No. 9, pp. 404–405.) The electron current between the cathode and a surrounding anode is found to increase appreciably when the cathode is illuminated, through a hole in the anode, by light from a Hg arc or a 150-W lamp. The sensitivity as a photoelectric device, for the valves used, was at a maximum for anode voltages of +30 V to +50 V and cathode temperatures from 850° K to 900° K.

621.385.4 **608**

Experimental Audio Output Tetrode.—W. S. Brian. (*Electronics,* Aug. 1947, Vol. 20, No. 8, pp. 121–123.) A tetrode in which the first grid is connected by a resistor to the 250-V supply and acts as a space-charge grid, while the second grid is used as the control electrode. Harmonic distortion is less than with a beam tetrode.

621.385.832 : [537.291 + 538.691 **609**

Electron Beam Deflection : Part 1 — Small-Angle Deflection Theory.—R. G. E. Hutter. (*J. appl. Phys.,* Aug. 1947, Vol. 18, No. 8, pp. 740–758.) The 'path' and 'iconal' mathematical methods for studying the effects of electric and/or magnetic fields on electron beams are discussed.

"These methods are then applied to describe the action of balanced two-dimensional electric deflection fields on electron beams. It is shown that both methods yield essentially the same results. Expressions are derived describing the magnitude of deflection and the distortions of an electron beam.

"Only the 'path' method is used in a similar investigation of magnetic-type deflection fields." A summary of part of this paper and of part 2 (to be published later) was noted in 3346 of 1947.

621.396.615.141.2 **610**

On the Effect of an External Electromagnetic Field on a Split Anode Magnetron.—S. Ya. Braude. (*Zh. tekh. Fiz.,* 1943, Vol. 13, Nos. 7/8, pp. 431–449. In Russian.) A magnetron with a static characteristic represented approximately by a polynomial of the 5th degree is considered. Formulae are derived determining the oscillations for various conditions and also the amplification factors for weak and strong signals.

621.396.615.142.2 **611**

Reflex Oscillators.—J. R. Pierce & W. G. Shepherd. (*Bell Syst. tech. J.,* July 1947, Vol. 26, No. 3, pp. 460–681.) A comprehensive account. A broad theoretical discussion is given first ; reflex oscillators vary so widely in construction that theoretical results form a better basis for generalization about their properties than experimental results. Mathematical calculations are relegated to a series of appendices. Many factors, such as multiple transits of electrons, different drift times for different electron paths and space charge in the repeller region, are not ordinarily taken into account although they can be quite important. It would not be difficult to fit a large body of data to a theory, correct or incorrect, which takes into account all observed effects.

The theory given must be regarded only as a guide to the capabilities of these oscillators and to their design rather than as an accurate, quantitative tool. The following oscillators developed at Bell Telephone Laboratories are then discussed: (*a*) beating oscillators, (*b*) the 707, which has an external resonator, (*c*) the 723, which has an integral cavity, (*d*) the 2K29, designed to eliminate hysteresis, (*e*) the 2K25, a broad-band oscillator, (*f*) the 2K45, thermally tuned, (*g*) the 2K50, with wave-guide output, (*h*) the 1464, a millimetre-range oscillator, and (*i*) the 2K23 and 2K54, for pulsed applications.

621.396.615.142.2 **612**

On the Effects of Space Charge in Velocity-Modulation Valves with Drift Bunching.—R. Warnecke, P. Guénard & C. Fauve. (*Ann. Radioélect.*, July 1947, Vol. 2, No. 9, pp. 224–231.) A discussion of the two-cavity klystron, used as an amplifier with high output and medium gain. Certain assumptions are made concerning the dimensions of the drift tube, the constitution of the electron beam, the magnetic focusing and the modulation of the initial velocity, and an approximate formula is derived for the fundamental component of the electron current in the two cases where the beam is (*a*) infinitely wide, and (*b*) of limited cross-section.

621.396.615.142.2 **613**

Facts about Klystrons.—O. P. Ferrell. (*CQ*, July 1946, Vol. 2, No. 7, pp. 16–17..63.) Discussion of the theory of their operation, and their use for super-high-frequency amateur radio.

621.396.615.142.2 **614**

Velocity-Modulated Reflex Oscillator.—J. M. Lafferty. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1947, Vol. 35, No. 9, pp. 913–919.) Small-signal theory for plane electrodes, neglecting space charge but including finite electron transit time at the modulator gap. The fundamental-frequency component of the tank-circuit current, the condition for self-starting and the dependence of frequency on reflector and beam voltages are derived. Curves are given of efficiency as a function of K (peak r.f. voltage/beam voltage) and β (retarding field transit angle).

621.396.645.029.64 **615**

On the Theory of U.H.F. Amplifiers.—Siforov. (*See* 379.)

621.396.694 **616**

Simplified Extrapolation Method of obtaining the Saturation Curves of Transmitting Valves.—R. Suart. (*Radio franç.*, ? July 1947, pp. 21–24.)

621.396.615.142.2 **617**

Klystron Tubes. [Book Review]—A. E. Harrison. McGraw Hill, New York, 1947, 271 pp., $3.50. (*Electronics*, Sept. 1947, Vol. 20, No. 9, p. 258.) The general behaviour, including the functions of cavities and electron beams, is explained for various types of klystron. Methods of modulation and measurement are also described.

MISCELLANEOUS

06.064 London : 621.396 **618**

The Olympia Show.—(*Wireless World*, Oct. 1947, Vol. 53, No. 10, pp. 362–386.) An illustrated stand-to-stand guide to the National Radio Exhibition, Olympia, London, October 1947. See also *Electronic Engng*, Oct. 1947, Vol. 19, No. 236, pp. 306–319; *Elect. Times*, 2nd Oct. 1947, Vol. 112, No. 2917, pp. 383–388; *Wireless Engr*, Nov. 1947, Vol. 24, No. 290, pp. 333–342, and 524 above.

06.064 Manchester : 621.38/.39 **619**

Manchester Electronics Exhibition.—(*Electronic Engng*, Oct. 1947, Vol. 19, No. 235, pp. 296–297.) Brief descriptions of a few of the exhibits.

5 + 6](054) **620**

Research : A Journal of Science and Its Applications.—A new monthly journal whose first number appeared in October, 1947, published by Butterworths Scientific Publications Ltd, 4–6 Bell Yard, Temple Bar, London W.C.2. The annual subscription is 45s. ($10 in U.S.A.). One of the aims will be to fill the gap uncovered by journals of learned societies, technical journals and popular journals, so that the technical specialist may get a general idea of what is going on in other fields. It also has the object of helping the pure scientist to bridge the enormous gap between invention and production.

53 Langevin **621**

The Scientific Work of Professor Paul Langevin.—M. R. Lucas. (*Onde élect.*, Aug./Sept. 1947, Vol. 27, Nos. 245/246, pp. 357–358.) A short account of Langevin's contributions to the kinetic theory of gases, the theory of diamagnetism and of paramagnetism, the theory of relativity and the practical applications of supersonics.

539.17 **622**

Nucleonics.—A new monthly journal with this title has been published since Sept. 1947; *Atomic Engineering* and *Atomic Power* are incorporated in it. The editorial and circulation offices are at 330 West 42nd St., New York 18; the subscription rate in the U.S.A. is $15 per annum.

621.316.98/.99 **623**

H.F. Testing of Lightning-Conductor Earths.—V. Fritsch. (*Elektrotech. u. Maschinenb.*, Sept./Oct. 1947, Vol. 64, Nos. 9/10, pp. 142–148.)

621.38 (42) + 621.38 (73) **624**

Current Overseas Technical Developments.—J. N. Briton. (*Proc. Instn Radio Engrs, Aust.*, Aug. 1947, Vol. 8, No. 8, pp. 10–14. Discussion, pp. 14–15.) A survey of recent technical and commercial progress made in Britain and America, with special reference to the development of extended frequency range disk recording, monochromatic and colour television and v.h.f. f.m. broadcasting systems.

621.396.69 : 384 **625**

Future Trend in Radio Component Design.—G. A. T. Burdett. (*Tech. Bull. Radio Component Mfrs' Fed.*, Sept. 1947, Vol. 1, No. 5, pp. 2–5.) A high standard of technical reliability is now possible at a competitive price provided that sufficient quantities are run off at one time. The technical implications of this fact are discussed.

621.396.712 **626**

Guide to Broadcasting Stations. [Book Review]—Iliffe & Sons, London, 3rd edn, 64 pp., 1s. (*Wireless Engr*, Nov. 1947, Vol. 24, No. 290, p. 344.)

ABSTRACTS AND REFERENCES

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to the World List practice.

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ACOUSTICS AND AUDIO FREQUENCIES

534.114 **627**

A Note to appraise Some Possible Causes of the Pressure/Frequency Effect of the Tuning Fork.—M. P. Johnson. (*J. sci. Instrum.*, Oct. 1947, Vol. 24, No. 10, pp. 253–254.) The causes considered are (*a*) variation of damping, (*b*) variation of physical dimensions, (*c*) change in density of the carried air, (*d*) change in thickness of the carried moisture. Consideration of an observed pressure/frequency curve shows that (*c*) is the most important.

534.132 **628**

On the Radiation of Sound from an Unflanged Circular Pipe.—H. Levine & J. Schwinger. (*Phys. Rev.*, 15th Oct. 1947, Vol. 72, No. 8, p. 742.) Summary of Amer. Phys. Soc. paper. A rigorous solution has been obtained for the propagation of waves along a semi-infinite pipe, valid throughout the wavelength range of the dominant mode. The gain and radiation pattern are derived, and the absorption cross-section for a wave incident normally on the mouth is found to be the geometrical area. When λ is large compared to the pipe diameter, the end correction is shown to be 0.613 3.

534.321.9 : 534.24 **629**

The Vertical Reflection of Supersonic Sound from the Sea Bottom.—R. W. Raitt. (*Phys. Rev.*, 15th Oct. 1947, Vol. 72, No. 8, p. 745.) Summary of Amer. Phys. Soc. paper. Experimental results all indicate diffuse reflection.

534.43 + 621.395.625.2] : 621.395.813 **630**

Intermodulation Distortion Analysis as applied to Disk Recording and Reproducing Equipment.—H. E. Roys. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1947, Vol. 35, No. 10, pp. 1149–1152.) A more sensitive method than the single-frequency harmonic method is the measurement of intermodulation frequencies. An abrupt increase in distortion occurs when the groove velocity falls below a certain value which increases with the radius of the stylus. Various forms of distortion, including that caused by wear of the stylus tip or groove walls, can be readily measured by the inter-modulation method.

534.43 : 621.395.61 **631**

High-Frequency Equalization for Magnetic Pickups.—C. G. McProud. (*Audio Engng, N.Y.*, Sept. 1947, Vol. 31, No. 8, pp. 13–15.) Methods of using shunt capacitance, for Pickering and General Electric pickups, to provide low-pass filter action and compensation for the recording characteristic of disk records. See also 3760 of 1947, U.D.C. of which should read as above.

534.43 : 621.395.61 **632**

A New Phonograph Pickup Principle.—A. E. Hayes, Jr. (*Audio Engng, N.Y.*, Oct. 1947, Vol. 31, No. 9, p. 14.) A method enabling a capacitive pickup to give an audio output equal to that of the magnetic type while retaining the advantages of low vibratory mass, relative freedom from resonance peaks in the desired spectrum, and good linearity.

534.43 : 621.396.665 **633**

High-Fidelity Volume Expander.—Pickering. (*See* 696.)

534.614 (26) **634**

An Acoustic Interferometer for the Measurement of Sound Velocity in the Ocean.—R. J. Urick. (*Phys. Rev.*, 15th Oct. 1947, Vol. 72, No. 8, p. 746.) Summary of Amer. Phys. Soc. paper. A fixed-path variable-frequency instrument which records small changes of sound velocity when lowered from a surface vessel. Results are compared with calculations made from bathythermograph and thermopile observations.

534.86 : 534.322.1 **635**

Factors influencing Studies of Audio Reproduction Quality.—N. M. Haynes. (*Audio Engng, N.Y.*, Oct. 1947, Vol. 31, No. 9, pp. 15–17, 35.) See also 10 of January (Olson) and back references.

534.861.1 **636**

Dynamic Symmetry and Acoustic Room Design.—M. Rettinger. (*Audio Engng, N.Y.*, Oct. 1947, Vol. 31, No. 9, pp. 12–13, 48.) Discusses the acoustic and aesthetic advantages of choosing the dimensions of a rectangular studio so that there shall be a suitable relationship between the shape of the whole and that of any parts into which it may be divided. Non-circular cross-sections for wood splays are also considered.

621.395.623.8 **637**

Multi-Lingual Interpreting Systems.—C. A. Tuthill. (*Audio Engng, N.Y.*, Sept. 1947, Vol. 31, No. 8, pp. 10–12, 46.) Describes the a.f. installation in three conference rooms at the United Nations headquarters at Lake Success. The output from each delegate's microphone is fed through an amplifier and control system to five interpreters in separate soundproof booths. The output from each interpreter's microphone is fed through separate amplifiers and local selector switches to the delegates' headphones. A brief description is given of the installation, which uses a low-power f.m. radio transmitting system. See also 1992 of 1947.

621.395.625.2 **638**

Force at the Stylus Tip while cutting Lacquer Disk-Recording Blanks.—H E. Roys. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, pp. 1360–1363.)

621.395.625.2 : 621.317.79 **639**

F.M. Calibrator for Disc Recording Heads.—Schlegel. (*See* 773.)

621.395.625.2 : 621.317.79 **640**

Applications of the F.M. Calibrator.—Schlegel. (*See* 774.)

621.395.625.3 **641**

The Magnetophon.—D. V. R. Drenner. (*Audio Engng, N.Y.*, Oct. 1947, Vol. 31, No. 9, pp. 7–11, 35.) A magnetic tape recorder developed by the German General Electric Company and I.G. Farben. Plastic-base tapes eliminate background 'hiss' and h.f. current biasing in the recording process reduces noise level and increases frequency response. Typical tape and electrical troubles and their causes are discussed and performance details given. See also 2320 of 1947 and back references.

621.395.625.3 : 016 **642**

Bibliography of Magnetic Recording.—N. M. Haynes. (*Audio Engng, N.Y.*, Oct. 1947, Vol. 31, No. 9, pp. 30–31 . . 45.) A chronological list including American and foreign articles.

AERIALS AND TRANSMISSION LINES

621.315.212 **643**

Broad-Band Noncontacting Short Circuits for Coaxial Lines : Part 2 — Parasitic Resonances in the Unslotted S-Type Plunger.—W. H. Huggins. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1947, Vol. 35, No. 10, pp. 1085–1091.) These resonances may occur in the gap between the plunger and the outer conductor when λ is somewhat less than a submultiple of the mean circumference of this gap. Resonances for the gap between the plunger and the inner conductor are affected by resonator tuning ; for a $3\lambda/4$ resonator, two such resonances occur for values of λ a little greater and a little less than the mean circumference of the gap. Plunger eccentricity produces strong coupling of the principal resonator mode with 'one-cycle' circumferential resonances, but only slight coupling with 'multiple-cycle' circumferential resonances. Part 1: 330 of February.

621.315.212 **644**

Broad-Band Noncontacting Short Circuits for Coaxial Lines : Part 3.—W. H. Huggins. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, pp. 1324–1328.) A theory of the resonances in a slotted plunger based upon a loaded-transmission-ring model. The wavelengths at which the parasitic resonances occur, as calculated from this model, are in satisfactory agreement with experimental measurements made upon a typical plunger. Ordinarily an odd number of slots is preferable to an even number ; parasitic resonances are more readily controlled in the Z-type than in the British S-type plunger. Part 1 : 330 of February. Part 2 : 643 above.

621.315.212 : [621.395 + 621.397.5 **645**

Coaxial-Cable Networks.—F. A. Cowan. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, pp. 1364–1367.) A general discussion on the technique of cable communication, with particular reference to telephony and to television links.

621.392.029.64 : 621.395.521.1 **646**

Hybrid Circuits for Microwaves.—Tyrrell. (*See* 678.)

621.392.029.64 : [669.71/.721 + 679.5 **647**

Aluminum Waveguides for Lightweight Communications Equipment.—Sherman. (*See* 755.)

621.392.029.64.012.8 **648**

The Equivalent Circuit of a Corner Bend in a Rectangular Wave Guide.—J. W. Miles. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, pp. 1313–1317.) The impedance representations are calculated for right-angle bends in, and transverse to, the plane of the electric field. The results are obtained as infinite series and shown graphically. See also 634 of 1947.

621.392.43 **649**

Broad-Band Wave-Guide Admittance Matching by Use of Irises.—R. G. Fellers & R. T. Weidner. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1947, Vol. 35, No. 10, pp. 1080–1085.) A stationary-wave detector is used to determine the optimum position and dimensions of a purely susceptive iris for matching the admittance of the load to that of the waveguide over a broad band of frequencies.

621.395.73 : 621.396.97 **650**

Short Telephone Lines in Broadcast Operation.—A. Sobel. (*Communications*, Sept. 1947, Vol. 27, No. 9, pp. 16–18, 21.) A discussion of methods of improving the frequency response of lines as short as 3 000 ft, by lowering the terminating impedance, at the expense of higher attenuation.

621.396.67 **651**

Performance of Short Antennas.—C. E. Smith & E. M. Johnson. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1947, Vol. 35, No. 10, pp. 1026–1038.) The performance of vertical aerials having a physical height of less than $\lambda/8$, under various conditions of top loading, is deduced from experimental data. Aerial resistance and reactance were measured between 120 and 400 kc/s, and field intensity was measured between 139 and 260 kc/s. Top loading increases the radiation resistance and lowers the capacitive reactance component of the driving-point impedance. This lowers the effective Q of the aerial and improves wide-band operation. With short aerials having a small resistance and a large capacitive reactance, extra precautions must be taken to minimize base-insulator losses. Extensive ground systems and high-Q loading coils are also of prime importance.

621.396.67 **652**

Element Spacing in 3-Element Beams.—P. C. Erhorn. (*QST*, Oct. 1947, Vol. 31, No. 10, pp. 37–42..118.) A series of tests on parasitic arrays to determine optimum element lengths for various standard spacings. A tuning procedure leading to consistently good performance is described.

621.396.67 : 621.397.5 **653**

WTTG TV Antennas.—G. E. Hamilton & R. K. Olsen. (*Communications*, Sept. 1947, Vol. 27, No. 9, p. 14.) Photographs and constructional features. See also 2262 and 3303 of 1947.

621.396.67 : 621.397.5 **654**

Biconical Television Antenna.—(*See* 839.)

621.396.67.029.62 **655**

A " Halo " for Six Meters.—F. H. Stites. (*QST*, Oct. 1947, Vol. 31, No. 10, pp. 24–27.) A compact aerial system for horizontally polarized radiation, consisting of a folded dipole bent into a circle and end-loaded. It has an essentially circular polar diagram.

621.396.67.029.64 **656**

Microwave Antenna Analysis.—S. Seely. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1947, Vol. 35, No. 10, pp. 1092–1095.) " The diffraction theory of Stratton and Chu is applied to a calculation of the vertical polar diagram and the gain of a parabolic cylindrical antenna. This antenna is fed by a line source having a known energy distribution and polarization. A numerical calculation for a particular profile is carried out, and the results are compared with those obtained experimentally. Satisfactory agreement between these results is found."

621.396.67.029.64 **657**

Parabolic-Antenna Design for Microwaves.—C. C. Cutler. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, pp. 1284–1294.) The fundamental properties and formulae relating to parabolic radiators are given and the relation of the phase, polarization and amplitude of the primary source or ' feed ' to the overall radiation characteristics is investigated theoretically. The characteristics of practical feed systems for parabolic aerials are discussed.

621.396.671 **658**

Mutual Impedance between Vertical Antennas of Unequal Heights.—C. R. Cox. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, pp. 1367–1370.) An expression is derived for the resistive and reactive components of the mutual impedance, the aerials being located above perfectly conducting ground. Mutual-impedance curves for typical combinations of aerial heights are plotted for spacings between 0.1λ and 1.0λ.

621.396.671 **659**

Partially-Screened Open Aerials.—R. E. Burgess. (*Wireless Engr*, Oct. 1947, Vol. 24, No. 289, pp. 309–310.) Author's reply to comment on 2681 of 1947 by Colino (3800 of 1947). By rearranging the differential equations for the screened portion of the aerial, it is shown that a coaxial mode exists, and independently an ' outer ' mode responsible for radiation from the screen. See also 2564 and 3158 of 1944.

CIRCUITS AND CIRCUIT ELEMENTS

621.314.222.018.42† **660**

Theory and Design of High-Power Pulse Transformers.—W. S. Melville. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 6, pp. 1063–1080.) " Describes the function and practical design of high-power pulse transformers as applied to radar pulse transmitters. The effects of pulse-transformer constants on the load pulse-shape are analysed and optimum values for the various relationships derived. The characteristics of magnetic core-materials under conditions of pulse magnetization, and practical and theoretical methods of measuring and estimating them are discussed. Apparatus for measuring pulse-magnetization characteristics is described." The paper is mainly practical; the mathematical analysis forms a convenient and useful appendix.

621.314.222.018.42† : 518.61 **661**

A Method of Virtual Displacements for Electrical Systems with Applications to Pulse Transformers.—P. D. Crout. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, pp. 1236–1247.) The transient behaviour of electrical systems with distributed constants is determined by a method which involves the association of a number of assumed ' current modes ' with generalized coordinates, and gives a set of equations which duplicates the mesh equations of a corresponding equivalent lumped network. The procedure can be applied to many types of problem. Equivalent networks, and procedures for calculating the constants in these networks, are obtained for the pulse transformer.

621.314.222.018.424† : 621.392.43 **662**

A Wide-Band Transformer from an Unbalanced to a Balanced Line.—E. G. Fubini & P. J. Sutro. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1947, Vol. 35, No. 10, pp. 1153–1155.) A discussion of the frequency characteristics of a $\lambda/4$ type of transformer. Two $\lambda/4$ sections of different characteristic impedance are placed in tandem in order to reduce the s.w.r. to less than 1.25 over a 4 : 1 frequency range.

621.314.26.029.64 : 621.396.622.6 **663**

Microwave Converters.—C. F. Edwards. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, pp. 1181–1191.) The operation and design of cartridge-crystal frequency-changer circuits for wavelengths below 10 cm are discussed, with particular reference to impedance matching. Various coaxial and waveguide arrangements (both narrow- and wide-band) are described in detail. The use of a hybrid junction in a waveguide enables a balanced frequency-changer to be used to eliminate both transfer of signal power into the beating oscillator and output from the noise sidebands of the oscillator. Summary noted in 1649 of 1946.

621.314.3† : 518.5 **664**

Special Magnetic Amplifiers and Their Use in Computing Circuits.—H. S. Sack, R. T. Beyer, G. H. Miller & J. W. Trischka. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, pp. 1375–1382.) The nonlinear transformer, which is the core of this apparatus, is based on the principle that both even and odd harmonics are generated if d.c. and a.c. are applied together to the primary of a transformer operating at saturation. Two equal transformers connected in opposition give even harmonics only, the amplitudes of which are proportional to the d.c. applied. They give an amplification of about 5 000 for the second harmonic. See also 159 of January (Beyer) for which the above U.D.C. would have been preferable.

621.316.728 + 621.316.935 **665**

Saturable Reactors for Load Control : Parts 1 & 2.—P. A. Vance. (*Gen. elect. Rev.*, Aug. & Sept. 1947, Vol. 50, Nos. 8 & 9, pp. 17–21 & 42–44.) Part 1 : General consideration of saturable reactors of the 'power-sized' range, their mode of operation and how they are applied. Part 2 : Discussion of core construction, methods of eliminating second harmonics by parallel operation of the a.c. coils, and calculation of circulating current and impedance.

621.316.86 **666**

Temperature-Dependent Resistors.—W. H. B. Cooper & R. A. Seymour. (*Wireless Engr*, Oct. 1947, Vol. 24, No. 289, pp. 298–306.) "An approximate analysis is given of the behaviour of a temperature-dependent resistor in an electrical circuit ; only relatively small changes of temperature are considered. The results are applied to the case of an oscillator which includes a temperature-dependent resistor as a control element."

621.317.35 **667**

Analysis of Lengthening of Modulated Repetitive Pulses.—S. C. Kleene. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1947, Vol. 35, No. 10, pp. 1049–1053.) An expression for the output after passage through a 'pulse lengthener' circuit was obtained by Ming-Chen Wang & G. E. Uhlenbeck (appendix of Radiation Laboratory Classified Report S-10, 16th May 1944, edited by J. L. Lawson). The present paper gives a derivation of the result in more detail, without restriction to the ideal case. An example of a pulse-lengthening circuit is given.

621.317.733 : 621.316.7 **668**

Bridge Unbalance used as a Process Control Factor.—(*Electronic Industr.*, Oct. 1947, Vol. 1, No. 10, pp. 4–5, 45.) Detailed analysis of the detector response in terms of the applied voltage and values of the resistances, for various types of bridge.

621.318.74 **669**

Single-Phase and Polyphase Filtering Devices using Modulation.—G. B. Madella. (*Wireless Engr*, Oct. 1947, Vol. 24, No. 289, pp. 310–311.) Comment on 2697 of 1947 (Barber). Barber's system is regarded as a 'polyphase' filtering device, and its chief advantage over a simple single-channel system is shown to be the ability to translate a frequency f_1, by modulating it with f_0, to a low frequency $f_1 - f_0$ (negative frequency indicating phase reversal), to filter it and restore it to f_1 by modulation with f_0, without introducing a 'mirror' frequency $f_0 - (f_1 - f_0)$.

621.392 **670**

A Square-Law Circuit.—J. H. P. Draper & D. G. Tucker. (*J. sci. Instrum.*, Oct. 1947, Vol. 24, No. 10, pp. 257–258.) A method for obtaining a voltage proportional at any instant to the square of the applied voltage. A low-level input is applied across a rectifier in series with a small resistance. The voltage across this resistance is connected in series-opposition with a suitable proportion of the applied voltage. The output approximates closely to the square of the input voltage.

621.392.001.1 **671**

Nodal Method of Circuit Analysis.—A. Preisman. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, p. 1335.) Comment on 39 of 1947 (Huggins).

621.392.43 **672**

The Exponential Conductor as Transformer.—O. Zinke. (*Funk u. Ton*, Sept. 1947, No. 3, pp. 119–129.) The work of Ruhrmann (620 of 1942) and of Wagner (3200 of 1942) is extended by means of diagrams relating the transfer ratio to l/λ, where l is the length of the exponential line. General equations and formulae are given, various loading conditions are discussed and compensation by the use of capacitors and inductors is described. It is found that the length of an exponential transformer can be reduced by a whole power of 10 if on the high-ohmic side a certain capacitance is connected in series and on the low-ohmic side an inductance is connected in parallel. The ratio of maximum to minimum wavelength for compensated transformers may in some cases exceed 15, but in others will be about 6. A numerical example is given.

621.392.5 : 518.5 **673**

Design of Mercury Delay Lines.—T. K. Sharpless. (*Electronics*, Nov. 1947, Vol. 20, No. 11, pp. 134–138.) Mercury transmits compression waves relatively slowly, introduces negligible loss and has an impedance comparable to that of crystal transducers. A mercury delay line, suitable for storing forty 0.3-μs pulses spaced 1 μs apart, consists of a 2-inch length of steel tube of internal diameter ½ inch. End caps are 7.5-Mc/s X-cut circular quartz crystals soldered to ceramic end pieces which are cut at an angle to reduce the reflected wave. Temperature compensation to within ± 0.3°C is provided. Auxiliary circuits for recirculation of pulse data are briefly described, with block and circuit diagrams. See also 2828 of 1947.

621.392.5 : 621.396.619.13 **674**

Network Transmission of a Frequency-Modulated Wave.—L. J. Giacoletto. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1947, Vol. 35, No. 10, pp. 1105–1106.) Comment on 1463 of 1946 (Frantz).

621.392.5.029.64 **675**

A Mathematical Theory of Directional Couplers.—H. J. Riblet. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, pp. 1307–1313.) By the suitable generalization of concepts used in discussing the lumped loading of a single transmission line, it is possible to discuss the interaction of the coupling elements of these more complicated circuits in a reasonably complete and elementary manner. Input impedances are analysed in terms of equivalent T and Π sections. The transformation of line impedances is shown to commute with similarity transformations, so that the circuit problem is equivalent to one involving independent but properly loaded transmission lines. The behaviour of many aperture-coupled directional couplers may be analysed by the use of a single conventional impedance diagram. A small-hole theory is given which predicts previously unexplained results.

621.392.52.011.2 **676**

The Direct Setting-Up of $Y^{\alpha\beta}$ for Junction Networks from the Network Diagram.—S. A. Stigant. (*Beama J.*, Oct. & Nov. 1947, Vol. 54, Nos. 124 & 125, pp. 348–353 & 385–389.) Articles complementary to those describing the setting-up of $Z_{\alpha\beta}$ for closed-mesh networks (2033 and 3820 of 1947). "A comparison of the two will disclose the 'dual' nature of the two types of circuits and their response characteristics. Each is self-contained."

621.392.53 **677**

Automatic Audio Phase Reverser.—A. H. Smith. (*Electronics*, Nov. 1947, Vol. 20, No. 11, pp. 156..162.) Comprises a 2-stage bridging audio amplifier, a balanced rectifier, and a RC delay network with output connected to the grid of a thyratron which actuates a polarity-switching relay. A switch presets the circuit so that on modulation peaks a transmitter will be modulated more positively than negatively, thereby reducing distortion. A complete circuit diagram is given.

621.395.521.1 : 621.392.029.64 **678**

Hybrid Circuits for Microwaves.—W. A. Tyrrell. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, pp. 1294–1306.) The fundamental behaviour of hybrid circuits is reviewed and discussed, largely in terms of reciprocity relationships. The phase properties of simple waveguide T-junctions are briefly considered. Two kinds of hybrid circuits are then described, the one involving a ring or loop of transmission line, the other relying upon the symmetry properties of certain four-arm junctions. The description is centred about waveguide structures for microwaves, but the principles may also be applied to other kinds of transmission line for other frequency ranges. Experimental verification is provided, and some important applications are outlined.

621.395.61[/.62].012.8 **679**

Approximate Equivalent Circuit for a Resonator Transducer.—W. R. MacLean. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1947, Vol. 35, No. 10, pp. 1095–1096.) The equivalent circuit of a high-Q transducer is given as a set of unit tank-circuit transducers connected in series on both ends. See also 1319 of 1941 (Condon).

621.395.645.33 : 578.088.7 **680**

Electro-Encephalograph Amplifier.—D. L. Johnston. (*Wireless Engr*, Aug.–Oct. 1947, Vol. 24, Nos. 287–289, pp. 231–242, 271–277 & 292–297.) An amplifier with frequency response from 0.15 c/s to 10 000 c/s, requiring a 15-μV peak-to-peak input signal for full output drive, and using a.c. supplies. Degenerative circuits eliminate critical balancing adjustments. A bibliography of 61 items is given.

621.396.611.21 **681**

Resonant Frequencies of n-Meshed Tuned Circuits.—L. A. Zadeh. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, p. 1335.) Comment on 2352 of 1947 (Parzen).

621.396.611.4 : 621.396.615.142 **682**

Loading of Resonant Cavities by Electron Beams.—W. G. Abraham. (*Phys. Rev.*, 15th Oct. 1947, Vol. 72, No. 8, p. 741.) Summary of Amer. Phys. Soc. paper. In cavities with grids the loading is found to be greater than that calculated from transit-time theory. This has been found experimentally to be due to two forms of secondary emission, the elimination of which enables the loading to be reduced to its transit-time value.

621.396.615.14 : 621.385.3 **683**

Triodes for Very Short Waves — Oscillators.—J. Bell, M. R. Gavin, E. G. James & G. W. Warren. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 5, pp. 833–846. Discussion, *ibid.*, Part III, 1947, Vol. 94, No. 31, pp. 364–368.) Suitable circuits for v.h.f. operation are discussed. Electron transit time is reduced by the use of very small grid-cathode spacings and by increasing the space current density to as much as 5 A/cm^2 under pulse conditions. Electrode-lead inductance is reduced by the use of disk seals, thus making the valve an integral part of the circuit. Several types of valve are described to illustrate the new techniques used; these include (*a*) a common-anode transmitting valve, Type NT99, a pair of which give 200 kW at 600 Mc/s; (*b*) a common-grid transmitting valve, Type CV288, a pair of which give 100 kW at 1 000 Mc/s, and (*c*) a common-grid receiving valve, Type CV273, giving 5 W at 1 000 Mc/s and 0.5 W at 3 000 Mc/s.

621.396.615.17 **684**

A Pretuned Bandpass Frequency Multiplier.—M. Silver. (*QST*, Oct. 1947, Vol. 31, No. 10, pp. 29–31..114.) Broad-band fixed-tuned circuits are applied to a frequency-multiplier unit which requires only the addition of a v.f.o. or crystal oscillator to give an output of 40 W on all amateur bands from 80 m to 6 m.

621.396.615.17 : 621.317.755 **685**

Oscilloscope Time-Base Circuit.—H. den Hartog & F. A. Muller. (*Wireless Engr*, Oct. 1947, Vol. 24, No. 289, pp. 287–292.) The normal method of synchronization of a Puckle timebase is analysed. A new method is described providing synchronization to an external signal from 150 to 1 700 c/s without adjustment of the timebase frequency control, and with a change in sweep amplitude of only 15%.

621.396.619 **686**

Selective Demodulation.—B. Starnecki. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, p. 1335.) Comment on 3059 of 1947 (Harris). The method there described was checked experimentally in Poland in 1934.

621.396.622.63 **687**

Crystal Valves.—B. Bleaney, J. W. Ryde & T. H. Kinman. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 5, pp. 847–854. Discussion, *ibid.*, Part III, 1947, Vol. 94, No. 31, pp. 339–343.) Design details are given for the high mechanical and electrical stability required for frequency conversion and detection at cm λ. The h.f. performance is analysed and measurements of conversion loss and noise temperature are described. The burn-out of crystals when used with pulsed radar sets is discussed and tests using d.c. pulses are described. Summary in *Wireless World*, March 1947, Vol. 53, No. 3, p. 89.

621.396.645 **688**

High-Frequency Amplification.—H. Jungfer. (*Funk u. Ton*, Sept. 1947, No. 3, pp. 130–141.) Discussion of the amplification and selectivity of a single stage, anode reaction and particular features of s.w. amplification, multi-stage amplifiers and heterodyne receivers, and interference and methods of reducing it.

621.396.645 **689**

Dynamic Performance of Peak-Limiting Amplifiers.—D. E. Maxwell. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, pp. 1349–1356.) Dynamic requirements for peak-limiting amplifiers are discussed briefly with respect to such factors as attack time, signal-to-thump ratio, gain-reduction characteristics, and recovery time. A novel measurement technique and apparatus for visual analysis are described.

621.396.645 : 621.396.96 **690**

Considerations in the Design of a Radar Intermediate-Frequency Amplifier.—A. L. Hopper & S. E. Miller. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, pp. 1208–1219.) A discussion of the choice of valves and the design of interstage coupling networks suitable for a mass-produced instrument with a bandwidth of 10 Mc/s and centre frequency either 60 or 100 Mc/s. Detailed circuits, construction, and performance are given of 60-db amplifiers (about 13 db per stage, with overall noise factor of 4.5 db at 60 Mc/s and 5.6 db at 100 Mc/s) using 6AK5 short-base pentodes with double-tuned transformer couplings.

621.396.645.029.62 **691**

H.F. F.M. Quadriline R.F. Amplifier.—R. G. Peters. (*Communications*, Sept. 1947, Vol. 27, No. 9, p. 36.) For another account see 70 of January.

621.396.645.029.63 **692**

A Wide-Band 550-Megacycle Amplifier.—R. O. Petrich. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, pp. 1371–1374.) A 5-stage amplifier with an overall bandwidth of 20 Mc/s and a gain of 10 db per stage. "It uses a 2C43 triode in a grounded-grid circuit with an impedance-transforming band-pass filter in the output to give the desired bandwidth. A visual method of alignment with a sweep-frequency oscillator is described, and important design considerations are given."

621.396.645.35 **693**

Electromechanical D.C. Amplifier.—C. G. Roper & J. F. Engelberger. (*Electronics*, Nov. 1947, Vol. 20, No. 11, pp. 117–119.) An account of the operating principles, mechanical details and applications of a compact instrument suitable for low-impedance low-current inputs. A moving-coil galvanometer system actuates a metal flag between the oscillator coils, providing high gain and stable amplification. Feedback from the output voltage may be applied to an extra coil in the galvanometer. Circuit diagrams and frequency characteristics are given, also a mathematical analysis of the feedback.

621.396.645.35 **694**

Sensitive D.C. Current-Amplifier operated from A.C.—S. Chapman. (*Phys. Rev.*, 15th Oct. 1947, Vol. 72, No. 8, p. 745.) Summary of Amer. Phys. Soc. paper. A simple 3-stage d.c. amplifier, with electrometer-valve input and variable negative feedback, operated from a stabilized supply. A meter deflection of 100 μA is produced by about 0.033 V.

621.396.662.3 : 621.392.029.64 **695**

Microwave Filters using Quarter-Wave Couplings.—R. M. Fano & A. W. Lawson, Jr. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, pp. 1318–1323.) A theoretical and detailed practical discussion of an adaptation of the conventional ladder-type filter in which the series elements are replaced by λ/4-line sections and the parallel elements by resonant elements of the cavity or iris type.

621.396.665 : 534.43 **696**

High-Fidelity Volume Expander.—N. C. Pickering. (*Audio Engng, N.Y.*, Sept. 1947, Vol. 31, No. 8, pp. 7–9, 39.) The controlled amplifier consists essentially of a single stage of push-pull amplification arranged to handle the loudest sound levels required. The gain is smoothly decreased over a range of 8–12 db by placing in parallel with the amplifier valves two control valves, whose grids are biased by the rectified output from an independent signal amplifier. With the control valves cut off, the amplifier valves work into their design load impedance; as current is allowed to increase in the control valves, the load impedance diminishes, and with it the gain of the stage. The effect is reinforced by variations of the common cathode bias. The control is arranged to function immediately after a change of input signal, but best results are obtained if the release is delayed for some seconds.

621.396.611.4 : 621.396.662.34 **697**

Kettenförmige Ultrakurzwellen-Bandfilter aus Quasistationären Schwingtöpfen. [Book Review]—F. Staub. Gebr. Leeman & Co., Zurich, 89 pp., 10 Swiss francs. (*Wireless Engr*, Oct. 1947, Vol. 24, No. 289, p. 308.) A doctorate thesis, dealing with theory, design, construction and testing of various types of u.s.w. band-pass filters for which cavity resonators are used.

GENERAL PHYSICS

530.14 **698**

The Interaction of Electrons and an Electromagnetic Field.—C. J. Eliezer. (*Rev. mod. Phys.*, July 1947, Vol. 19, No. 3, pp. 147–184.) The present state of knowledge of particle dynamics is discussed critically and the difficulties encountered in connection with the development of the various theories are briefly considered. The main body of the paper follows the lines of Dirac's quantum electrodynamics. The generalized Lorentz-Dirac equations are expressed in Hamiltonian form, and translated into the quantum theory. An investigation of the interaction of an electron and a radiation field is based on these new equations. The solution for the interaction is shown to be entirely free from divergent integrals to all orders of approximation in the perturbation theory.

530.162 : 519.2 **699**

On the Problem of Random Flights.—M. H. Quenouille. (*Proc. Camb. phil. Soc.*, Oct. 1947, Vol. 43, Part 4, pp. 581–582.) Comment on 2866 of 1943 (Chandrasekhar). See also 701 below.

530.162 : 519.2 **700**

The Resultant of a Large Number of Events of Random Phase: Part 2.—C. Domb. (*Proc. Camb. phil. Soc.*, Oct. 1947, Vol. 43, Part 4, pp. 587–589.) Coulson's criticism (701 below) of part 1 (278 of 1947) is accepted. For certain problems, however, the treatment of part 1 is a sufficiently good approximation. The theory is used to estimate the coherent contribution to the energy scattered back to a beamed radar equipment. In practice the coherent contribution is generally negligible compared with the incoherent term. The dependence of the coherent contribution on pulse shape, on the distance of the scattering cloud of particles, and on the operating wavelength is briefly indicated. See also 515 of 1947 (Ryde).

530.162 : 519.2 **701**

Note on the Random-Walk Problem.—C. A. Coulson. (*Proc. Camb. phil. Soc.*, Oct. 1947, Vol. 43, Part 4, pp. 583–586.) An alternative treatment to that used by Domb (278 of 1947) for obtaining the probability function of the sum of a number of vectors, each of random phase ϕ but each having an amplitude which is some given function of ϕ. The results of the analysis are critically compared with those of Domb. See also 700 above.

530.19 : 621.396.615.141.2 **702**

Scalar and Vector Potential Treatment.—P. I. Richards. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, pp. 1334–1335.) Smith & Shulman (3699 of 1947) have applied a variational method to the calculation of the change in the resonant frequency of a magnetron cavity due to the introduction of an electron beam. The derivation of their result numbered (74) can be simplified and considerably shortened by a so-called gauge transformation.

537.122 : 538.3 **703**

On the Self-Accelerating Electron.—S. Ashauer. (*Proc. Camb. phil. Soc.*, Oct. 1947, Vol. 43, Part 4, pp. 506–510.) After solving the equations of motion of Dirac's self-accelerating electron, a physical picture of it is formed by plotting graphically the surfaces of constant scalar potential when the electron has built up a velocity close to the velocity of light. See also 3459 of 1945 (Eliezer & Mailvaganam).

537.32 **704**

The Theory of the Thermoelectric Power of Metals.—E. H. Sondheimer. (*Proc. Camb. phil. Soc.*, Oct. 1947, Vol. 43, Part 4, pp. 571–576.)

538.122 : 518.4 **705**

Graphs of the Induced Magnetic Moment and Shielding Effect of a Spherical Shell in a Uniform Magnetic Field.—B. Tuckerman. (*Terr. Magn. atmos. Elect.*, Sept. 1947, Vol. 52, No. 3, pp. 369–373.)

538.221 **706**

Oscillations of Elementary Magnets.—V. Arkadiew. (*Nature, Lond.*, 20th Sept. 1947, Vol. 160, No. 4064, p. 397.) From a comparison with experimental data on magnetic dispersion and absorption bands for ferromagnetic materials, it is suggested that the theory of magnetic viscosity spectra is applicable to the lower frequencies but that the theory of elastic-viscous rotation of magnetic dipoles with a moment of inertia is more suitable in the cm λ region.

538.569.4 : 546.171.1 **707**

The Hyperfine Structure and the Stark Effect of the Ammonia Inversion Spectrum.—J. M. Jauch. (*Phys. Rev.*, 15th Oct. 1947, Vol. 72, No. 8, pp. 715–723.)

538.569.4.029.64 **708**

Microwave Spectra and Zeeman Effect in a Resonant Cavity Absorption Cell.—C. K. Jen. (*Phys. Rev.*, 15th Nov. 1947, Vol. 72, No. 10, p. 986.) A gas-filled resonant cavity is tuned to a spectral line at low pressure, using a klystron source with a linear frequency sweep. The absorption line appears on the normal resonance curve displayed on a c.r.o. A method of increasing the sensitivity of the spectroscope is described and used to demonstrate the Zeeman effect for microwave spectral lines. See also 3867 of 1947 (Coles & Good).

538.691 : 621.397.331.2 **709**

The Motion of Electrons subject to Forces transverse to a Uniform Magnetic Field.—P. K. Weimer & A. Rose. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, pp. 1273–1279.) The motion is investigated analytically for forces varying with time, and a graphical method of solution is described and applied to the electron motion in the orthicon type of television pickup tube.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

521.15 : 538.12 : 523.3 **710**

The Magnetic Field of the Moon?—S. Chapman. (*Nature, Lond.*, 20th Sept. 1947, Vol. 160, No. 4064, p. 395.) With reference to Blackett's recent theory of magnetism of massive bodies due to their rotation (3112 of 1947), the possibility is discussed of measuring the moon's magnetic field by rocket methods. This would check the theory for moments smaller than those hitherto considered. See also 3891 of 1947 (Babcock).

523.72 : 621.396.822.029.62 **711**

Relative Times of Arrival of Bursts of Solar Noise on Different Radio Frequencies.—R. Payne-Scott, D. E. Yabsley & J. G. Bolton. (*Nature, Lond.*, 23rd Aug. 1947, Vol. 160, No. 4060, pp. 256–257.) Discussion of observations made at Chippendale, N. S.W., mainly during July and August 1946 at frequencies of 200, 75 and 60 Mc/s, together with a few observations at 30 Mc/s. There is little correlation between the smaller bursts on different frequencies, while the larger bursts are similar in shape and nearly coincident in time; these associated bursts occur first on 200 Mc/s, then on 75 Mc/s, then on 60 Mc/s, the delays usually being of the order of 2 sec between consecutive frequencies; but delays of several minutes have occurred for exceptionally large outbursts, particularly that of 8th March 1947, for which diagrams are reproduced and heights and velocities of the sources of the disturbances estimated according to Martyn's suggestions (2088 of 1947). See also 96 of January (Ryle & Vonberg).

523.746 : 550.385 **712**

Sunspots and Telegraphy.—C. H. Cramer. (*Telegr. Teleph. Age*, Oct. 1947, Vol. 65, No. 10, pp. 9–10 .. 50.) Reprint of 3878 of 1947.

523.746 "1947.04/.06" **713**

Provisional Sunspot-Numbers for April to June, 1947.—M. Waldmeier. (*Terr. Magn. atmos. Elect.*, Sept. 1947, Vol. 52, No. 3, pp. 397–398.)

537.591 **714**

The Latitude Effect of the Hard Component as a Function of Altitude.—P. S. Gill, M. Schein & V. Yngve. (*Phys. Rev.*, 15th Oct. 1947, Vol. 72, No. 8, p. 733.)

537.591 **715**

On the Mass and the Disintegration Products of the Mesotron.—C. D. Anderson, R. V. Adams, P. E. Lloyd & R. R. Rau. (*Phys. Rev.*, 15th Oct. 1947, Vol. 72, No. 8, pp. 724–727.)

537.591 : 519.331 **716**

Investigations on the 27-Day Period of Cosmic Radiation.—H. Gheri & R. Steinmaurer. (*Terr. Magn. atmos. Elect.*, Sept. 1947, Vol. 52, No. 3, pp. 343–355. In German.) Modern statistical methods confirm the existence of the 27-day period. The variations show at times a close connection with the passage of large sunspot groups across the sun's disk and with magnetic storms.

550.38 (52) **717**

Recent Geomagnetic Data from Observatories and Stations in Japan.—K. Wadachi. (*Terr. Magn. atmos. Elect.*, Sept. 1947, Vol. 52, No. 3, pp. 410–412.)

550.38 "1947.01/.06" **718**

Cheltenham [Maryland] **K-Indices for January to June, 1947.**—W. E. Wiles. (*Terr. Magn. atmos. Elect.*, Sept. 1947, Vol. 52, No. 3, pp. 403–409.)

550.38 "1947.04/.06" **719**

K-Indices, April to June, 1947, and Sudden Commencements, January to June, 1947, at Abinger.—H. Spencer Jones. (*Terr. Magn. atmos. Elect.*, Sept. 1947, Vol. 52, No. 3, pp. 399–403.)

550.385 "1947.04/.06" **720**

Principal Magnetic Storms [April–June, 1947].—(*Terr. Magn. atmos. Elect.*, Sept. 1947, Vol. 52, No. 3, pp. 413–424.)

551.510.5 : 621.396.822.029.64 **721**

Microwave Sky Noise.—A. E. Covington. (*Terr. Magn. atmos. Elect.*, Sept. 1947, Vol. 52, No. 3, pp. 339–341.) Noise received on a 3 000-Mc/s aerial system with a 6° beam pointed towards the zenith was measured by the Dicke modulation technique (475 of 1947). The sky temperature fluctuations showed correlation with sudden magnetic disturbances and with auroral displays; on some occasions the sky temperature rises some minutes before sunrise and drops some minutes after sunset.

551.510.52 : 621.396.812.029.64 **722**

Radar Reflections from the Lower Atmosphere.—W. B. Gould. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1947, Vol. 35, No. 10, p. 1105.) Comment on 2769 of 1947 (Friis).

551.510.535 **723**

Critical Survey of Recent Theoretical Work on the Ionosphere.—A. Pande. (*Terr. Magn. atmos. Elect.*, Sept. 1947, Vol. 52, No. 3, pp. 375–396.) The relative merits of the work of numerous authors are discussed and particular attention is given to (*a*) determination of ionization density and collision frequency, (*b*) propagation through the ionosphere, (*c*) dissociation, detachment, and the reverse processes, and (*d*) composition and temperature of the upper atmosphere. A list of 118 references is included.

551.510.535 **724**

Rate of Electron Production in the Ionosphere.—S. L. Seaton. (*Phys. Rev.*, 15th Oct. 1947, Vol 72, No. 8, pp. 712–714.) Methods are developed for determining the rate throughout the 24 hours. "Application of the theory to experimental data shows that the rate of electron production varies more or less systematically from zero before sunrise to values around 800 electrons cm^{-3} sec^{-1} near noon at the equator for an equinoctial interval at sunspot minimum. The results are in general agreement with values determined over restricted time intervals during eclipse of the sun."

551.510.535 **725**

The Determination of Ionospheric Electron Distribution.—L. A. Manning. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, pp. 1203–1207.) "The virtual height versus frequency integral is derived, neglecting absorption and the earth's magnetic field. It is shown how solution of this integral equation can be obtained using the Laplace transformation, and how true height versus frequency can be determined graphically from virtual height versus frequency curves. Application of the method is made to some typical night time and day time ionosphere records."

551.510.535 **726**

Differential-Penetration Theory.—T. L. Eckersley. (*Terr. Magn. atmos. Elect.*, Sept. 1947, Vol. 52, No. 3, pp. 305–314.) When a neutral cloud of electrons and positive particles encounters the upper atmosphere, the electrons, owing to their short free path, are soon retarded while the positive particles penetrate to much greater depths. This sets up an electric field which is horizontal at sunrise and sunset and vertical at noon; it is also crossed by horizontal and vertical components of the earth's magnetic field.

The crossed fields cause drifts of the ions and these drifts explain the fall in F_2-layer ionization during magnetic storms, the F_2-layer ionization maxima north and south of the magnetic equator, and the sunrise G layer observed in Ceylon. See also 3500 of 1942.

551.510.535 : 523.745 **727**

The Ionosphere as a Measure of Solar Activity.—M. L. Phillips. (*Terr. Magn. atmos. Elect.*, Sept. 1947, Vol. 52, No. 3, pp. 321–332.) Experimental data show that, at any geographical location and for any ionized region, the relation between monthly mean critical frequency (f^0) and sunspot-number (S) is well represented by $f^0 = (S + A)F(t)$ where $F(t)$ is a function of the time of day and A is a constant. The standard deviations of the monthly from the yearly average of S are considerably greater than those of f^0.

551.510.535 : 523.78 "1947.07.09" **728**

Coronal Radiation and Ionospheric Variations during the Solar Eclipse, July 9, 1945.—M. Waldmeier. (*Terr. Magn. atmos. Elect.*, Sept. 1947, Vol. 52, No. 3, pp. 333–338.) "From the ionospheric observations made by O. Rydbeck [1777 of 1947] and from the coronal observations made by the author it is deduced that the source of the solar ultra-violet light, producing the E-layer, lies in the innermost part of the corona in the regions of highest intensity of the 5303-radiation. Very strong support to this conclusion is given by the fact that in these regions the temperature of the corona reaches its highest values."

551.510.535 : 550.385 : 621.396.812.3 **729**

Polar Radio Disturbances during Magnetic Bays.—H. W. Wells. (*Terr. Magn. atmos. Elect.*, Sept. 1947, Vol. 52, No. 3, pp. 315–320.) In 1942 in Alaska, 69 magnetic bays were observed and were accompanied by high absorption of radio signals below the E region, both for vertical and oblique incidence. It is suggested that both this ionization and sporadic-E ionization are caused by particle bombardment.

551.593.9 + 551.594.5 **730**

The Radiations from the Earth's Atmosphere.—S. Chapman & D. R. Bates. (*Nature, Lond.*, 23rd Aug. 1947, Vol. 160, No. 4060, pp. 250–251.) Discussion of existing knowledge of auroras and the night sky light. A conference on these subjects was organized by the Gassiot Committee of the Royal Society and held in London in July 1947. Papers read at the conference will be published by the Physical Society in *Reports on Progress in Physics*.

LOCATION AND AIDS TO NAVIGATION

621.396.96 **731**

Detectability and Discriminability of Targets on a Remote Projection Plan-Position Indicator.—W. R. Garner & F. Hamburger, Jr. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, pp. 1220–1225.) Quantitative results were obtained on minimum detectable signals and minimum separation between two targets as a function of the following variable factors: video gain, c.r. tube bias, signal clipping, light-source intensity, type of diffraction screen, and position of the operator. The projection (p.p.i.), using a dark-trace tube, appeared to be 1 db worse than a standard 5-inch p.p.i., when each instrument was operated under its optimum conditions.

621.396.96 : 531.55 **732**

Naval Fire-Control Radar.—J. F. Coales, H. C. Calpine & F. S. Watson. (*J. Instn elect. Engrs*, Part III, Sept. 1947, Vol. 94, No. 31, p. 346.) Discussion on 1798 of 1947.

621.396.96 : 531.55 : 621.396.621 **733**

The Development of Gun-Laying Radar Receivers Type G.L.Mk.1, G.L.Mk.1* and G.L./E.F.*—L. H. Bedford. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 6, pp. 1115–1122.) The early types used a null method of range measurement by means of an accurate potentiometer. The design of the basic G.L. system is described, with brief reference to the receiver, timebase and display, and details of the potentiometer arrangement. Later a self-contained unit was evolved in which elevation was determined by comparison of field strengths, using a goniometer and a high-angle aerial system.

621.396.96 : 621.317.79 **734**

Quantitative Radar Measurements.—Katzin. (*See* 779.)

621.396.96 : 621.385.832 : 535.371.07 **735**

Cathode-Ray-Tube Screens for Radar.—Garlick, Henderson & Puleston. (*See* 885.)

621.396.96 : 621.385.832.087.3 **736**

Visibility of Cathode-Ray-Tube Traces in Radar Displays.—Hopkinson. (*See* 889.)

621.396.96 : 621.396.61/.62 **737**

Various Papers on Transmitters, Receivers, Modulators, etc. for Radar.—See Transmission and Reception sections.

621.396.96 : 621.396.645 **738**

Considerations in the Design of a Radar Intermediate-Frequency Amplifier.—Hopper & Miller. (*See* 690.)

MATERIALS AND SUBSIDIARY TECHNIQUES

537.228.1 **739**

Culturing Crystals.—(*Electronics*, Nov. 1947, Vol. 20, No. 11, p. 144.) A brief account of the commercial production of piezoelectric crystals of ethylene diamine tartrate (EDT) for crystal filters.

537.228.1 **740**

New Low-Coefficient Synthetic Piezoelectric Crystals for Use in Filters and Oscillators.—W. P. Mason. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1947, Vol. 35, No. 10, pp. 1005–1012.) Crystals of ethylene diamine tartrate (EDT) and dipotassium tartrate (DKT) can be cut so that they have zero temperature coefficients within useful temperature ranges. These crystals have high Q, little or no water of crystallization, high electromechanical coupling, and are a suitable substitute for quartz for use in electrical wave filters. DKT has higher stability than EDT under varying conditions of temperature, but is harder to grow and requires more careful handling. The properties of EDT are described, with details of the 13 elastic constants, 8 piezoelectric constants, and the 4 dielectric constants, which have been measured over a temperature range in order to locate the regions of low temperature coefficients and high electromechanical coupling. The properties of six cuts with low temperature coefficient are discussed. These cuts are being applied in the crystal channel filters of a long-distance telephone system. With a crystal 0.3 mm thick, frequencies as high as 13 Mc/s may be used in the control of oscillators. For a very high degree of frequency stability, quartz crystals are preferable.

537.228.1 : 546.431.823 : 621.315.612.4 **741**

Piezoelectric Effect in Polycrystalline Barium Titanate.—W. L. Cherry, Jr, & R. Adler. (*Phys. Rev.*, 15th Nov. 1947, Vol. 72, No. 10, pp. 981–982.) A polycrystalline $BaTiO_3$ ceramic will become piezoelectric if subjected to a field strength of the order of 20 kV/cm for an hour. When the field is removed, the piezoelectric effect at first decreases rapidly but eventually reaches an equilibrium value about 85% of its initial value. This equilibrium value can be maintained for several months.

The piezoelectric axis lies in the direction of the applied field. An alternating field applied in the same direction produces axial vibrations while an applied field at right angles to the axis produces shear vibrations. The electromechanical coupling coefficient exceeds that of quartz by a factor of 4 or 5.

539.232 : 546.77 **742**

Thin Oxide Films on Molybdenum.—E. A. Gulbransen & W. S. Wysong. (*Metals Technol.*, Sept. 1947, Vol. 14, No. 6, Tech. Publ. No. 2226, 17 pp.) Vacuum microbalance measurements on the oxidation of Mo at temperatures of 250°C–450°C, the reduction of surface films of oxide at temperatures of 500°C–600°C, the volatility of oxide films, and vacuum oxidation of the metal at high temperatures.

539.232 : 546.78 **743**

Thin Oxide Films on Tungsten.—E. A. Gulbransen & W. S. Wysong. (*Metals Technol.*, Sept. 1947, Vol. 14, No. 6, Tech. Publ. No. 2224, 17 pp.) Vacuum microbalance measurements on the oxidation of tungsten and the reduction of the oxides under various conditions of temperature and pressure. Oxidation is studied at temperatures up to 550°C and reduction at temperatures of 500°C–700°C. The vacuum behaviour of the oxide film at temperatures of 600°C–1025°C is also described.

539.233 : 669.15.26 **744**

Passivity in Chromium-Iron Alloys; Adsorbed Iron Films on Chromium.—H. H. Uhlig. (*Metals Technol.*, Sept. 1947, Vol. 14, No. 6, Tech. Publ. No. 2243, 10 pp.) Iron electroplated or evaporated on to a chromium surface is found to be passive at the interface. An adsorption process similar to that occurring with alkali metals on tungsten is suggested. The amount of passive iron adsorbed by an etched chromium surface indicates an adsorbed layer about one atom thick.

539.87 **745**

Stratosphere Chamber.—(*Engineer, Lond.*, 26th Sept. 1947, Vol. 184, No. 4783, pp. 296–298.) A full description, with detail drawings and dimensions, of the Vickers-Armstrongs chamber for reproducing atmospheric conditions at any altitude up to 70 000 ft, for testing aircraft components.

The temperature range is +70°C to −55°C, and later will be extended to −70°C, the minimum pressure is 0.05 atmosphere and the rate of evacuation is equivalent to a rate of climb of 1 000 ft/min, which can be increased to 3 000 ft/min.

546.287 : 621.315.62 : 621.315.612.6 **746**

Silicone Coatings for Glass Insulators.—A. E. Williams. (*Elect. Times*, 30th Oct. 1947, Vol. 112, No. 2921, pp. 507–508.) Liquid dimethylsilicones have recently been developed to produce water-repellent surfaces on glass insulator bodies. Their use has been investigated by O. K. Johannson and J. J. Torok, of Corning Glass Works, U.S.A. They are water-white, inert, non-toxic, non-corrosive and oxidation resistant. Their electrical volume resistivities are at least $10^{14}\,\Omega$-cm and power factors less than 0.000 2 at frequencies up to 8 Mc/s. The surface of the article to be treated should be thoroughly cleaned before dipping in a dilute solution of the liquid silicone in an inert solvent. The article is then drained, allowed to dry, and baked.

546.97 **747**

Rhodium — Engineering Properties and Uses.—L. B. Hunt. (*Metal Ind., Lond.*, 24th Oct. 1947, Vol. 71, No. 17, pp. 339–342.) Rhodium is a typical metal of the platinum group; it has a high melting point, great stability and outstanding resistance to corrosion. It is mainly used as a finishing material in electrodeposited form, when its resistance to mechanical wear is excellent. Rhodium can maintain a low and stable contact resistance, because surface films are not formed. It is therefore particularly suitable for l.v. electrical contacts.

620.178.1 **748**

A Non-Destructive Magnetic Hardness Tester.—W. H. Meiklejohn. (*Electronic Industr.*, Oct. 1947, Vol. 1, No. 10, pp. 14–15, 45.) Describes an instrument suitable for accurate testing of the hardness of small homogeneous steel pivots. The instrument depends on the linear relationship between the magnetic and hardness properties of the steel.

620.197.1 : 621.396.69 **749**

The Hermetic Sealing of Transformers and Chokes used in Communication Equipment.—C. F. Bays & D. Slater. (*J. Instn elect. Engrs*, Part III, Sept. 1947, Vol. 94, No. 31, pp. 347–357.) Existing methods of protection have not been found completely satisfactory for tropical use and hermetic sealing is necessary. The design and suitability of plastic containers and of containers for bitumen-filling and air-filling are considered in detail. The properties of possible filling media are discussed and the methods of filling described. X-ray photographs of bitumen-filled transformers indicate the extent of filling under pressure. Measurements of insulation resistance and temperature rise of loaded transformers of various types and under various conditions are given. Air-filling is recommended for small transformers with working voltages less than 5 kV.

621.3.015.5.029.63/.64 : 546.217 **750**

Experiments on the Electric Strength of Air at Centimetre Wavelengths.—R. Cooper. (*J. Instn elect. Engrs*, Part III, Sept. 1947, Vol. 94, No. 31, pp. 315–324.) The spark gaps used for the experiments took the form of constrictions in coaxial-line or waveguide transmission systems for wavelengths of 10.7 cm or 3.06 cm respectively. The electric stress was applied in the form of recurrent impulses. The power transmitted was measured by means of a water calorimeter and the electric stress at the gap was found by calculation. Details of the apparatus and the experimental techniques are given. Measurements were made with both irradiated and non-irradiated gaps of different lengths and the results compared with the continuous direct breakdown stress at atmospheric pressure. Measurements at pressures less than atmospheric were also made.

621.315.61 **751**

Insulation of Electrical Machines.—P. N. Vickerman. (*Trans. S. Afr. Inst. elect. Engrs*, Aug. 1947, Vol. 38, Part 8, pp. 205–224. Discussion, pp. 224–229.) Detailed discussion of some natural and certain of the newer synthetic insulating materials, with particular reference to the windings of rotary machines. The importance of complete impregnation and selection of a suitable varnish is stressed and the use of silicone resins and greases recommended for increased operating temperatures.

621.315.612 : 621.315.59 **752**

Semiconducting Ceramic Materials.—H. H. Hausner. (*J. Amer. ceram. Soc.*, 1st Sept. 1947, Vol. 30, No. 9, pp. 290–296.) The principles of electrical conductivity are briefly reviewed. The conductivity of compositions consisting mainly of oxides such as TiO_2, Fe_2O_3, Fe_3O_4 and ZrO_2 is investigated and correlated with theory.

621.318.23 **753**

Magnet Design for Large Air-Gaps.—E. C. S. Megaw. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 93, No. 5, pp. 939–948.) By electric circuit analogy, supplemented by experimental data, design formulae are developed for magnets of uniform and of tapered cross-section for given field strengths in the air gaps and given gap dimensions. The relationship between gap dimensions and the degree of non-uniformity in the gap field is also discussed with reference to magnetron magnets.

621.318.323.2 : 669.15 **754**

High-Frequency Excitation of Iron Cores.—J. D. Cobine, J. R. Curry, C. J. Gallagher & S. Ruthberg. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1947, Vol. 35, No. 10, pp. 1060–1067.) Techniques for studying the core loss and exciting impedance of iron alloys intended for use in wide-band transformers are described. H.f. sine-wave and wide-band random-noise excitation were used. The frequency range was 0.1–5 Mc/s. The alloys investigated included hipersil, monimax, molybdenum permalloy and B9W4A.

669.71/.721 + 679.5] : 621.392.029.64 **755**

Aluminum Waveguides for Lightweight Communications Equipment.—R. Sherman. (*Communications*, Oct. 1947, Vol. 27, No. 10, pp. 28. . 35.) Methods of bending, machining, brazing and copper-plating aluminium to make waveguides are discussed. For plating, a stainless steel rod anode is used to improve the inner surfaces. Magnesium and certain plastics are also briefly considered as possible waveguide materials.

679.5 : 621.397.5 : 535.316/.317 **756**

British [plastic] **Lenses combine Molding, Casting.**—D. Starkie. (*Mod. Plast.*, Oct. 1947, Vol. 25, No. 2, pp. 107–109.) A general survey of the uses and methods of manufacture of plastic mirrors and lenses. See also *Nature, Lond.*, 19th July 1947, Vol. 160, No. 4055, p. 99.

MATHEMATICS

518.5 **757**

The Present State and Trends of Development of Calculating Technique.—N. E. Kobrinski & L. A. Lyusternik. (*Vestnik Akad. Nauk.*, 1946, Nos. 8/9, pp. 97–116. In Russian.) A general discussion, covering analogue and digital machines. Sources of error are considered. A theorem due to S. A. Gershgorin states that a rod mechanism can be built representing any algebraic integral function of a complex variable. By combining a number of simple mechanisms almost any mathematical relationship can be realized. The operation of a machine developed by L. I. Gutenmacher for integrating differential equations in terms of partial derivatives of Laplace's equation is explained. Devices dealing with discrete values are considered with special reference to those using punched cards.

518.5 : 621.314.3† **758**

Special Magnetic Amplifiers and Their Use in Computing Circuits.—Sack, Beyer, Miller & Trischka. (*See* 664.)

518.5 : 621.392.5 **759**

Design of Mercury Delay Lines.—Sharpless. (*See* 673.)

518.61 : 621.314.2.015.33 **760**

A Method of Virtual Displacements for Electrical Systems with Applications to Pulse Transformers.—Crout. (*See* 661.)

MEASUREMENTS AND TEST GEAR

529.78 **761**

Synchronous Clock Control.—(*Electrician*, 10th Oct. 1947, Vol. 139, No. 3617, p. 1077.) A 50-c/s output of 15 W or 30 W, sufficient to drive 10 or 20 clocks, is derived by frequency division and subsequent amplification from a 100-kc/s quartz crystal with an absolute accuracy better than 1 in 10^5. Arrangements are provided for comparison with a mechanical standard clock and for correction of the driven clocks.

531.761 : 621.317.39 **762**

The Measurement of Ultra-Short Time Intervals.—S. H. Neddermeyer, E. J. Althaus, W. Allison & E. R. Schatz. (*Rev. sci. Instrum.*, July 1947, Vol. 18, No. 7, pp. 488–496.) Brief description noted in 3662 of 1946 (Neddermeyer). The superposition locus of transient pulses travelling in opposite directions along a transmission line is used to determine the interval between the times of generation of the pulses.

531.761 : 621.317.39 **763**

Recorder and Timer for Short Intervals.—W. H. Bliss. (*Electronics*, Nov. 1947, Vol. 20, No. 11, pp. 126–127.) For intervals up to 16 μs. Accuracy is within 0.25 μs. Intervals to be measured may occur at random and be widely separated.

531.761 : 621.317.755 **764**

Spiral Sweep Oscilloscope Timer.—R. B. Moran, Jr. (*Electronics*, Oct. 1947, Vol. 20, No. 10, pp. 120–123.) Circuit details are given for an oscilloscope whose spiral trace revolves with uniform angular velocity 180°/μs; the display is photographed. Intervals from 25 to 100 μs between two pulses can be measured within 0.05 μs by determining the angular distance between the corresponding traces on the photograph.

621.317.374.029.62/.63 : 621.396.611.4 **765**

Improved Re-Entrant Cavity.—S. I. Reynolds. (*Gen. elect. Rev.*, Sept. 1947, Vol. 50, No. 9, pp. 34–39.) A high-Q cavity has a capacitor, adjustable by micrometer, across an inductance in series with the main air gap. The cavity is used for dielectric loss measurements at 400–600 Mc/s. An oscillator is coupled through a low-pass filter and an attenuator, and Q measurements are made before and after the specimen is inserted. An accuracy of ± 1% is claimed. Observations on fused quartz are tabulated.

621.317.725 : 518.3 **766**

Voltmeter Loading.—R. E. Lafferty. (*Electronics*, Nov. 1947, Vol. 20, No. 11, pp. 132–133.) An abac giving true voltage in a high-impedance circuit when measurements are made with two different voltage ranges of an ordinary low-sensitivity voltmeter.

621.317.725 : 621.385.2 **767**

The Diode as an A.C. Voltmeter.—C. S. Bull. (*J. sci. Instrum.*, Oct. 1947, Vol. 24, No. 10, pp. 254–256.) Existing methods are subject to error when measuring very low or very high voltages. The proposed method demands less stability in the valve and supply voltages. Using a calibrated d.c. voltmeter and a microammeter, the calibration curve can be expressed in the form $y = I_0(BV_0)$ where B is determined experimentally and V_0 is the peak a.c. voltage. For a typical diode this curve is suitable for voltages from a few millivolts to 0.4 V. The range may be extended by a method similar to the slide-back method but having a precisely calculable calibration capable of experimental verification. The power absorbed from the source can be calculated.

621.317.727.027.213 **768**

Self-Balancing Potentiometer.—T. A. Rich & G. F. Gardner. (*Gen. elect. Rev.*, Sept. 1947, Vol. 50, No. 9, pp. 29–32.) A sensitive galvanometer provided with a mirror reflects light into two photocells which are connected to amplifiers whose opposed outputs are fed into a standard resistor. Deflection of the galvanometer causes unequal beams to fall on the photocells and a current therefore flows through the resistor. For inputs up to 24 mV, the maximum in-balance current is 10^{-8} A. Suggested applications include measurement of temperature differences, flux measurement, use as a d.c. amplifier, and measurement of d.c. supply regulation voltage.

621.317.75 **769**

Wide-Range Double-Heterodyne Spectrum Analyzers.—L. Apker, J. Kahnke, E. Taft & R. Watters. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1947, Vol. 35, No. 10, pp. 1068–1073.) An instrument, which covers the range 10–3 000 Mc/s, is described and its performance discussed. The signal frequency is converted to 24 600 Mc/s by a crystal mixer and a special beating oscillator with modulation frequency of about 1 Mc/s. A band-pass filter, made up of tuned cavities and a $\lambda/4$ guide, rejects undesirable frequencies and passes the output to a second crystal where the frequency is converted to 115 Mc/s, using a beating oscillator with a.f.c. The signal is then amplified and applied to a c.r. display unit.

Two other analysers using production oscillators and covering smaller ranges are also mentioned.

621.317.755 **770**

Oscillograph Recording Systems: Part 1—Single Frequency Timing.—(*Electronic Industr.*, Oct. 1947, Vol. 1, No. 10, pp. 6–7.) Various deflecting circuits are discussed and the patterns given by them are illustrated.

621.317.755 : 621.317.73 **771**

An Oscillographic Method of presenting Impedances on the Reflection-Coefficient Plane.—A. L. Samuel. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, pp. 1279–1283.)

621.317.755 : 621.385.1.012 **772**

Producing Tube Curves on an Oscilloscope.—H. E. Webking. (*Electronics*, Nov. 1947, Vol. 20, No. 11, pp. 128–131.) A general description, with block and simple circuit diagrams, of equipment in which all types of valves may be tested. Characteristic curves can be obtained under most combinations of operating conditions by means of calibrated controls. The effect of cathode and screen degeneration may also be observed. A family of curves is produced simultaneously by using a stepping circuit to vary the grid voltage.

621.317.79 : 621.395.625.2 **773**

F.M. Calibrator for Disc Recording Heads.—R. A. Schlegel. (*Audio Engng*, May & June 1947, Vol. 31, Nos. 4 & 5, pp. 18–20 & 20–23.) A device for making various measurements of the behaviour of a recording head during actual recording, including changes in frequency response, distortion, linearity, etc.

621.317.79 : 621.395.625.2 **774**

Applications of the F.M. Calibrator.—R. A. Schlegel. (*Audio Engng*, July 1947, Vol. 31, No. 6, pp. 28–30.) See also 773 above.

621.317.79 : 621.396.615 : 621.397.62 **775**

Television Signal Generator.—J. Fisher. (*F.M. & Televis.*, Oct. 1947, Vol. 7, No. 10, pp. 24–28.) A 6-channel crystal-controlled generator with video and frequency modulation, for testing overall television receiver performance. A standard R.M.A. television signal is produced, and all standards such as negative modulation, transmission of the d.c. component, percentage of the r.f. signal devoted to synchronizing pulses, depth and linearity of modulation, and crystal control of carrier frequency are maintained. Block and circuit diagrams of the various units are given, together with component ratings, construction and calibration details.

621.317.79 : 621.396.615.14 **776**

Wide-Range Ultra-High-Frequency Signal Generators.—A. V. Haeff, T. E. Hanley & C. B. Smith. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1947, Vol. 35, No. 10, pp. 1137–1143.) The war-time development by the U.S. Naval Research Laboratory of signal generators covering the frequency range 90–9 700 Mc/s is surveyed, with brief descriptions of the design, performance and limitations of the various models. These are capable of giving c.w. or pulse outputs which have a range in output level of more than 100 db below 0.1 V across a 50-Ω output impedance, with an absolute accuracy of approximately 1 db. The output attenuators are of the mutual-inductance, cylindrical-waveguide type; they are discussed in some detail. For several of the generators external a.m. or internal f.m. can be provided.

621.317.79 : 621.396.641.001.4 **777**

Testing Repeaters with Circulated Pulses.—A. C. Beck & D. H. Ring. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, pp. 1226–1230.) An extension of square-wave and pulse testing techniques is described which permits the signal pulse to be observed after circulating many times through the transmission system under test. This method is particularly useful for measuring the cumulative effect of a number of similar units, such as those used in carrier or microwave radio repeater systems, when only one unit is available. Applications to video-frequency, i.f. and r.f. testing with a.m. or f.m. signals are discussed.

621.317.79 : 621.396.812 **778**

Recording Sky-Wave Signals from Broadcast Stations.—W. B. Smith. (*Electronics*, Nov. 1947, Vol. 20, No. 11, pp. 112–116.) A Canadian system in which signal strength is recorded on a strip chart for several hours. A photoelectric scanner determines the fraction of the time for which the signal exceeds any selected value. Analysis of the charts takes about 10 minutes for a 2-hour recording period, compared with several hours when using manual methods. Summary in *Proc. Inst. Radio Engrs, W. & E.*, Oct. 1947, Vol. 35, No. 10, p. 1053

621.317.79 : 621.396.96 **779**

Quantitative Radar Measurements.—M. Katzin. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, pp. 1333–1334.) Substitution methods used at the U.S. Naval Research Laboratory for measuring echo power, aerial gain, etc., are described. Standard test sets, combining the functions of power meters and signal generators, are used and only power ratios are measured, so that accuracy depends essentially on the calibration of the test-set attenuator.

621.317.79 : 621.397.62.001.4 **780**

Television Receiver Production Test Equipment.—J. A. Bauer. (*Communications*, Sept. & Oct. 1947, Vol. 27, Nos. 9 & 10, pp. 8–11 . . 35 & 18 . . 47.) A description of equipment set up at Camden, New Jersey, to test up to 500 receivers a day. Units described include a composite video generator unit with synchronizing generator, monoscope camera, master monitor, grating generator and distributing amplifiers.

621.396.61/.62].001.4 : 621.396.96 **781**

A Technique for the Production Testing of Radar Responders.—H. Wood. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 6, pp. 1113–1114.) Describes the development of laboratory and production test equipment and methods, discusses signal-generator and c.r.o.-display requirements and gives a method for testing the suppression system necessarily associated with the responder when this is operated in close proximity to transmitters.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

531.767 : 629.135 : 621.396.9 **782**

Radio Doppler Effect for Aircraft Speed Measurements.—L. R. Malling. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, pp. 1357–1360.) Technical details of system using signals transmitted from the ground, received in the aircraft and retransmitted to the ground for measurement of the Doppler effect.

539.16.08 **783**

Carbon Dioxide Filled Geiger-Müller Counters.—S. C. Brown & W. W. Miller. (*Rev. sci. Instrum.*, July 1947, Vol. 18, No. 7, pp. 496–500.) Description of a CO_2–CS_2 counter which has satisfactory properties for routine studies of C^{14}.

621.316.718.5.076.7 **784**

Electronic Motor Control.—(*Beama J.*, Oct. 1947, Vol. 54, No. 124, p. 360.) A short general description of the Philips system, which provides a flexible variable-speed drive with finger-tip controls.

621.317.733 : 621.316.7 **785**

Bridge Unbalance used as a Process Control Factor.—(*See* 668.)

621.317.755 : [531.714 + 531.781 **786**

Cathode-Ray Recording Micrometer and Force Gauge.—J. Ewles & C. Curry. (*J. sci. Instrum.*, Oct. 1947, Vol. 24, No. 10, pp. 261–265.) The movement of a coil attached to the object under test produces a voltage which may be examined by means of a c.r.o. Rapidly varying movements of the order of 3 mm may be measured to an accuracy of 0.002 5 mm.

621.317.755 : 531.787 : 614.83 **787**

Measuring Pressures of Industrial Explosions.—N. J. Thompson & E. W. Cousins. (*Electronics*, Nov. 1947, Vol. 20, No. 11, pp. 90–93.) A capacitance-type pickup feeds a c.r.o. through a 10-kc/s bridge and gives pressure/time diagrams; it is calibrated on static pressures. An automatic tripper circuit responds to explosions.

621.317.79 : 531.714.7 **788**

Technical Data on Electronic Micrometer.—(*Electronics*, Nov. 1947, Vol. 20, No. 11, pp. 172 . . 180.) Designed to measure insulation thickness. The instrument has two ranges, 0–0.005 inch and 0–0.05 inch. Accuracy about 1%. Detailed circuit diagram given.

621.38 : 621.316.718 : 655.324.5 **789**

Electronic Computer for Printing Control.—J. W. Ludwig. (*Electronics*, Nov. 1947, Vol. 20, No. 11, pp. 108–111.) An electronic-hydraulic system which controls the position of a running register to within 0.001 inch.

621.38.001.8 : 623.95 **790**

Developments on Magnetic and Acoustic Mines at the Admiralty Mining Establishment.—A. J. Baggot & C. H. Fawcett. (*J. Instn elect. Engrs*, Part I, Nov. 1947, Vol. 94, No. 83, pp. 509–526.) An outline of basic principles and historical development. Methods of detecting ships and countering the effects of explosions and sweeps are described, the development of mine circuits from the single-contact circuit to the combined dual detection circuits is traced and details are given of mines and components. The use of magnetic detection as a trigger device for heavy battery-current electronic circuits is also described and British and German mining are briefly compared.

621.383 + 621.385.38] : 621.316.74 **791**

Continuous Control Thermoregulator.—P. Wright. (*J. sci. Instrum.*, Oct. 1947, Vol. 24, No. 10, pp. 258–261.) A photocell-thyratron type controlling an electric furnace by means of a saturated choke in series with the furnace windings. Temperature fluctuations due to variations in supply voltage were reduced by a factor of 1/100.

621.384 **792**

The Radiation Transformer.—R. Wideröe. (*Schweiz. Arch. angew. Wiss. Tech.*, Aug. & Oct. 1947, Vol. 13, Nos. 8 & 10, pp. 225–232 & 299–311.) An account of the historical development of devices such as the cyclotron and their mode of operation, with derivation of the fundamental equations and description of new types of construction. Magnetic lens stabilization is discussed and a description given of a 15-MeV radiation transformer.

621.384.6 **793**

Theory of the Synchro-Cyclotron.—D. Bohm & L. L. Foldy. (*Phys. Rev.*, 15th Oct. 1947, Vol. 72, No. 8, pp. 649–661.) In the synchro-cyclotron, f.m. of the alternating dee potential compensates for the reduction of angular velocity as the electrons approach the speed of light, but at the expense of reduced efficiency of electron capture. The maximum obtainable capture efficiency is proportional to the square root of either the dee voltage or the rate of f.m., and is of the order of 0.1–2% for present designs.

621.384.6 **794**

The "Gigator" [1 Gigavolt = 10^9 V] **—A Proposed New Circular Accelerator for Heavy Particles.**—R. Wideröe. (*Phys. Rev.*, 15th Nov. 1947, Vol. 72, No. 10, p. 978.) A device in which two separate accelerating systems operate alternately on the ions. In each system the frequency of the accelerating voltage may be chosen to be an integral multiple of the circulation frequency of the ions. As the velocity of the ions increases, the frequency of the accelerating field is changed by discontinuous steps to a lower multiple of the circulation frequency. The various possible accelerating frequencies in one system fall between successive pairs of such frequencies in the other. It is thus possible to bring the ions from one synchronous condition to another without excessive loss of ions from the beam.

621.384.6 **795**

Internal Cyclotron Targets.—A. F. Reid. (*Rev. sci. Instrum.*, July 1947, Vol. 18, No. 7, pp. 501–503.) The preparation and design of targets to be used within the dee enclosure for the production of radioactive elements are discussed.

621.385.15 **796**

The Behavior of "Magnetic" Electron Multipliers as a Function of Frequency.—L. Malter. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1947, Vol. 35, No. 10, pp. 1074–1076.) A theoretical and experimental study of the frequency variation of gain. The variation is shown to be similar to that obtained with e.s. multipliers (1063 of 1941) when expressed as a function of over-all electron transit angle. For frequencies up to 500 Mc/s, loss in gain can be ascribed to the spread in transit angle.

621.395.645.33 : 578.088.7 **797**

Electro-Encephalograph Amplifier.—Johnston. (*See* 680.)

623.978 + 550.838] : 538.71 **798**

A Magnetic Airborne Detector employing Magnetically Controlled Gyroscopic Stabilization.—V. Vacquier, R. F. Simons & A. W. Hull. (*Rev. sci. Instrum.*, July 1947, Vol. 18, No. 7, pp. 483–487.) An experimental type of airborne magnetometer is described using three mutually perpendicular saturable-core magnetometers. Signals from two of these magnetometers are used to precess an air-driven gyroscope so as to align its spin axis with the earth's total magnetic field, thus providing stabilization for the third magnetometer which can then measure anomalies of a few gammas along the line of flight. With this method of stabilization, the magnetometer can be used in vehicles subjected to the most violent angular accelerations. It can also be made smaller than non-gyroscopically stabilized airborne magnetometers. See also 220 of January (Felch et al.).

621.38/.39 **799**

Electronics. [Book Review]—B. Lovell (Ed.). Pilot Press, London, 660 pp., 42s. (*Wireless Engr*, Oct. 1947, Vol. 24, No. 289, pp. 306–307.) Contains 14 chapters by 13 different authors on different subjects having in common only their dependence on electronics. Subjects covered include electron physics, photocells, television, valves, radar, h.f. heating, servomechanisms, electronics in medicine, the betatron, and electron microscopy. Each chapter has a bibliography and there is a good subject index.

PROPAGATION OF WAVES

621.396.11 **800**

The Calculation of Field Strengths over a Spherical Earth.—C. Domb & M. H. L. Pryce. (*J. Instn elect. Engrs*, Part III, Sept. 1947, Vol. 94, No. 31, pp. 325–336. Discussion, pp. 337–339.) Curves and formulae are given for the calculation of the field strength at any height and distance from the transmitter for the case of horizontally polarized waves over a curved earth or sea. Well within the optical range the field is calculated by ray theory (perfect ground conductivity assumed). At exact optical cut-off the field is calculated from the diffraction formula by an approximate method and for points well beyond optical range the field is given by the first term of the diffraction formula. The field-strength/distance curve is then completed smoothly through the optical cut-off point. The case of vertically polarized waves is also briefly discussed and curves and formulae given for the regions well within and well beyond optical cut-off. See also 2892 of 1947 (Booker & Walkinshaw).

621.396.11 : 551.510.52 **801**

Propagation of Radio Waves in the Lower Troposphere.—J. B. Smyth & L. G. Trolese. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, pp. 1198–1202.) The reflection coefficient of the transition layer between an underlying mass of cold air and an overlying mass of warm air is calculated from formulae given by Epstein (1931 Abstracts, p.31) and Eckart (*Phys. Rev.*, June 1930, Vol. 35, pp. 1303–1309). Reflections from this layer explain some propagation characteristics of a 90-mile non-optical link at San Diego, for various frequencies between 50 and 600 Mc/s.

621.396.11.029.6 **802**

Radio Propagation at Frequencies above 30 Megacycles.—K. Bullington. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1947, Vol. 35, No. 10, pp. 1122–1136.) The theory of propagation over a smooth spherical earth is presented in a simplified form made possible by restricting the frequency range. The effects of frequency, distance, aerial heights, curvature of the earth, atmospheric conditions, and the presence of hills and buildings are discussed, most of the quantitative data being presented in a series of abacs. By means of these an estimate of received power and field intensity for a given point-to-point transmission can be quickly obtained. The empirical methods used in estimating the effects of hills and of atmospheric refraction are compared with experimental data on shadow losses and fading ranges.

621.396.11.029.62/.63 **803**

Ultra-Short-Wave Propagation Studies beyond the Horizon.—A. H. Waynick. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, p. 1334.) Certain results previously reported (671 of 1941) have been re-examined. They appear to confirm conclusions of Wickizer & Braaten (3628 of 1947) and to indicate that, for the experimental conditions involved, the portion of the atmosphere effective in returning signals towards the earth is that below about 1.5 km.

621.396.812.029.64 : 551.510.52 **804**

Radar Reflections from the Lower Atmosphere.—W. B. Gould. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1947, Vol. 35, No. 10, p. 1105.) Comment on 2769 of 1947 (Friis).

621.396.812.3 : 551.510.535 : 550.385 **805**

Polar Radio Disturbances during Magnetic Bays.—Wells. (*See* 729.)

RECEPTION

621.396.61/.62 **806**

A Lightweight Mobile Transmitter-Receiver.—(*See* 848.)

621.396.619.16 : 621.396.96 **807**

Time Demodulation.—B. Chance. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1947, Vol. 35, No. 10, pp. 1045–1049.) Description of methods for precision demodulation which depend upon a time modulator synchronized with the input information, a time discriminator, and negative feedback connections to control the local time modulator, in order to reproduce the modulating signal in an electrical or mechanical form. Accuracy is usually determined by the bandwidth of the receiver, and may be 5 parts in 10^4 or better.

621.396.621 : 621.396.96 : 621.396.66 **808**

Some Automatic Control Circuits for Radar Receivers.—L. A. Moxon, J. Croney, W. G. Johnston & C. A. Laws. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 6, pp. 1143–1158.) Application of a.f.c. and a.g.c. to radar receivers. The importance of a.f.c. depends chiefly on the ratio of bandwidth to operating frequency. A.f.c. appears generally to be a desirable refinement at λ 10 cm and becomes essential with further increase in frequency. A discriminator circuit derives a d.c. voltage from the wanted signal, positive or negative according to the tuning error. The discriminator output is applied after amplification to either a mechanical or an electronic frequency-changing device. The limitation of clutter is one of the main functions of a.g.c. 'Swept gain', quick acting a.g.c. and differentiation are among the devices used. Gain equalization on two receiving channels may be achieved by feeding a locally generated r.f. signal through equal paths into the two channels during idle periods. This signal can be used to operate a.g.c. systems on each receiving channel.

621.396.621 : 621.396.96.029.62 **809**

The Development of C.H.-Type Receivers for Fixed and Mobile Working.—J. W. Jenkins. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 6, pp. 1123–1129.) The development of the chain or C.H. type of radar receiver between the years 1937 and 1942, including (*a*) mechanical construction: accuracies of 0.2° to 0.4° were achieved with mass-produced goniometers; (*b*) r.f. circuits: anti-paralysis features assured constant gain; (*c*) pulse circuits: mobile receivers derived all pulses from the power supply waveform; (*d*) auxiliary functions, including identification and anti-jamming devices.

621.396.621.029.62 **810**

A Compact and Inexpensive Superhet for 144 Mc/s.—B. C. Barbee. (*QST*, Oct. 1947, Vol. 31, No. 10, pp. 33–36.)

621.396.621.54 : 621.396.82 **811**

Exit Heterodyne QRM.—J. L. A. McLaughlin. (*QST*, Oct. 1947, Vol. 31, No. 10, pp. 13–16.) An improved method of receiving signals through heterodyne beat-note interference, by use of a triple-detector superheterodyne circuit. Either of two crystal-controlled oscillators at 405 kc/s and 505 kc/s converts the first i.f. of 455 kc/s to a second i.f. of 50 kc/s. The 50-kc/s i.f. system acts as a high-pass filter, so that by using one or other of the oscillators either sideband can be rejected, and with it the undesired signal.

621.396.82 : 551.57 : 629.135
621.319.74 : 551.57 : 629.135 **812**

Electrostatic Ills.—J. H. Willox : R. Beach. (*Elect. Engng, N.Y.*, Oct. 1947, Vol. 66, No. 10, pp. 1044–1046.) Criticism of 2916 of 1947 and the author's reply.

621.396.82 : 621.396.619.13 **813**

Investigation of Frequency-Modulation Signal Interference.—I. Plusc. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1947, Vol. 35, No. 10, pp. 1054–1059.) The causes of interference between two f.m. signals are analysed. Co-channel interference is practically independent of receiver design. Off-channel interference depends on the shape of the discriminator curve more than 120 kc/s off resonance. The amount of interference for a given receiver is calculated in terms of the relative strength of the interfering signal. Circuit modifications to reduce interference are suggested.

621.396.822 : 621.396.621 : 534.78 **814**

The Influence of Amplitude Limiting and Frequency Selectivity upon the Performance of Radio Receivers in Noise.—W. J. Cunningham, S. J. Goffard & J. C. R. Licklider. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1947, Vol. 35, No. 10, pp. 1021–1025.) An experimental study of the relations between the effectiveness of voice communication as measured in terms of intelligibility of received speech, and the amplitude- and frequency-selective characteristics of a.m. receivers. Amplitude limiters, although ineffective against fluctuation noise, provide marked improvement in performance against impulse noise when the receivers have appropriate selectivity. With no limiter, narrow-band circuits have a slight advantage over wide-band circuits. When a limiter is used, narrow-band circuits have a slight advantage for fluctuation noise. For optimum reception in the presence of impulsive noise, the frequency-selective circuits which precede the limiter should have broad-band characteristics to preserve the waveform of the pulse.

621.396.822 : 621.396.65 : 621.396.41 **815**

Fluctuation Noise in Pulse-Height Multiplex Radio Links.—L. L. Rauch. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, pp. 1192–1197.) "Expressions are obtained for the channel fluctuation noise of pulse-height multiplex systems used over f.m. and a.m. radio links. A comparison shows the f.m. channel fluctuation-noise improvement to be 4.15 times the deviation ratio, in contrast to the familiar $\sqrt{3}$ times the deviation ratio for single-channel radio links."

621.396.822 : 621.396.96 **816**

The Noise Characteristics of Radar Receivers.—L. A. Moxon. (*J. Instn elect. Engrs*, Part IIIA 1946, Vol. 93, No. 6, pp. 1130–1142.) Of the quantities which determine the performance of radar receivers, noise factor in amplifiers and mixers has received most attention. Equivalent circuits, particularly as developed by Herold and Malters (3357 of 1943 and 797 of 1944) are of value in the theoretical treatment of noise in amplifiers, and give results in close agreement with experiment. Results indicate that bandwidth and noise are independent for bandwidths up to about 4 Mc/s. The VR136 pentode in which screen current is reduced by alignment of the grids, the grounded-grid triode and the neutralized triode circuit are among important amplifier developments of the last few years. The two best methods of obtaining low noise factor use either a low i.f. or a neutralized triode. In the region of 90–600 Mc/s, the grounded-grid triode is at present the best method of r.f. amplification. Among mixer problems, local oscillator noise at low i.f. can best be combated by the balanced mixer system recently developed in America.

To realize the best performance of crystal mixers an overall performance measurement or its equivalent should be included in the factory selection of crystal valves. Methods which use only l.f. or high level measurements and neglect noise may pass crystals as identical which actually have a spread of several db. An average improvement of 2 db should be realized with proper test methods.

STATIONS AND COMMUNICATION SYSTEMS

621.395/.396 **817**

Radio versus Line for Communication Systems.—(*J. Instn elect. Engrs*, Part III, Sept. 1947, Vol. 94, No. 31, pp. 357–358.) I.E.E. discussion, opened by A. H. Mumford, on the particular features and relative merits of the two systems.

621.395.43 : 621.396.619.16 **818**

Pulse Code Modulation.—(*Audio Engng, N.Y.*, Oct. 1947, Vol. 31, No. 9, pp. 31, 43.) For other accounts of pulse-code modulation systems see 258 of January (Batcher) and 545 of February (Goodall).

621.395.44 : 621.315.052.63 **819**

Power-Line Carrier Communications.—R. C. Cheek. (*Communications*, Aug. 1947, Vol. 27, No. 8, pp. 20–21..46.) An analysis of systems operating in the 50–150-kc/s band.

621.396.65 : 621.396.97 **820**

F.M. Chain Broadcasting.—A. A. McK. (*Electronics*, Nov. 1947, Vol. 20, No. 11, pp. 94–98.) A general account of methods used since 1939 to relay high-fidelity programmes from station to station in North America, including one technique eliminating conversion to a.f.

621.396.65.029.64 : 621.316.726.029.64 **821**

Simplified Microwave A.F.C. : Part 1.—Jenks. (*See* 847.)

621.396.712 **822**

Planning an F.M. Broadcast Station.—R. S. Lanier. (*F.M. & Televis.*, Oct. & Nov. 1947, Vol. 7, Nos. 10 & 11, pp. 35–38 & 28–30.) A review of the facilities required and of modern methods of design, based on the replies of broadcast engineers and consultants to a detailed questionnaire.

621.396.712 : 69 **823**

F.M. and A.M. Broadcast Transmitter Buildings.—(*Communications*, Oct. 1947, Vol. 27, No. 10, pp. 20–21..38.) "Factors to be considered in laying out the building and choosing a building site."

621.396.712(73) **824**

F.M. Broadcasting Stations in the U.S.—(*F.M. & Televis.*, Oct. 1947, Vol. 7, No. 10, pp. 39..54.)

621.396.712.3 **825**

Planning a [broadcasting] **Studio Installation : Parts 2 & 3.**—J. D. Colvin. (*Audio Engng, N.Y.*, Aug. & Sept. 1947, Vol. 31, Nos. 7 & 8, pp. 30–31..41 & 25–28.) Part 2 : the arrangement of the console panel and the associated cables and conduits. Part 3 : suggestions concerning (*a*) equipment to be purchased before construction begins and (*b*) preparation of wiring diagrams. Part 1 : 4034 of 1947. To be continued.

621.396.931 **826**

Two-Way Taxicab Radio Fleet Installation.—R. W. Malcolm. (*Communications*, Oct. 1947, Vol. 27, No. 10, pp. 12–13..43.) A system supplementing the company's elaborate telephone network and enabling taxicabs to report their destination and to receive instructions en route. See also 272 of January.

621.396.931.029.62 **827**

Power Company F.M. System.—E. W. Brown. (*Communications*, Oct. 1947, Vol. 27, No. 10, pp. 14–16.) For maintaining two-way communication between breakdown service crews and a central office, which has a 60-W 31.46-Mc/s transmitter whose aerial is 212 ft above ground, giving a service range of 25 miles. The mobile units are rated at 30 W.

621.396.933 **828**

V.H.F. Airborne Communications System.—S. A. Meacham. (*Communications*, Oct. & Dec. 1947, Vol. 27, Nos. 10 & 12, pp. 22..36 & 18–19.) Description of 2-way equipment operating at 118–132 Mc/s, with a transmitter output of 50 W. Based on war-time equipment, the system is of unit construction. Any of 70 channels, each of which is crystal controlled in both transmitter and receiver, can be selected by a motor-driven switch. Circuit diagrams of transmitter and receiver are given.

SUBSIDIARY APPARATUS

621-526 **829**

I.E.E. Convention on Automatic Regulators and Servo Mechanisms.—(*J. Instn elect. Engrs*, Part I, Nov. 1947, Vol. 94, No. 83, pp. 527–549.) Abstracts of the papers noted in 4039 of 1947 and of the following papers: Data-Transmission Systems, by J. Bell. Automatic Control applied to Modern High-Pressure Boilers, by L. Young.

621.314.653 : 621.3.032.43 **830**

The Ignition Mechanism of Relay Tubes with Dielectric Igniter.—N. Warmoltz. (*Philips tech. Rev.*, 1947, Vol. 9, No. 4, pp. 105–113.) Ignition methods for which a pool of mercury is used as cathode are surveyed, with particular reference to the capacitive method in which a positive voltage of several kilovolts is applied to a conductor separated from the mercury cathode by a thin insulating wall. The action is explained with the aid of Tonks' theory (1324 of 1936). It is suggested that the mercury surface becomes unstable and is drawn out to sharp points at which the field strength is sufficient to produce field emission, after a certain time lag.

621.316.722.1 **831**

A.C. Voltage Stabilizers.—L. L. Helterline, Jr. (*Audio Engng, N.Y.*, Sept. 1947, Vol. 31, No. 8, pp. 23–24, 43.) A specially made tungsten filament diode is used as one arm of a bridge network. Alteration of line voltage causes a corresponding change in anode resistance of the diode, unbalancing the bridge. The unbalance voltage is fed into the grid of a beam power valve which draws its anode current through the d.c. winding of a saturable reactor, the a.c. coils of which act as a variable reactance in the line circuit.

Characteristic curves are given showing output voltage constant to within less than 0.5% for a line voltage varying from 90 V to 135 V.

621.319.51 : 621.316.91 **832**

An Enclosed Spark-Gap for Overvoltage Protection.—H. de B. Knight & L. Herbert. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 6, pp. 1058–1062.) A sealed, hydrogen-filled spark-gap with glass envelope is described, which satisfies the conditions (*a*) that breakdown should occur, with no time lag, at a voltage slightly above the normal operating voltage, (*b*) that deionization should be rapid, and (*c*) that breakdown should be independent of previous breakdowns and also of atmospheric pressure and temperature. Breakdown voltages of 5 and 16 kV were standardized, but experimental units for 22 kV were made. Hydrogen pressures up to 2 atmospheres were used. A robust design with a ceramic envelope is also described.

621.319.51 : 621.396.96 **833**

The Development of Triggered Spark-Gaps for High-Power Modulators.—J. D. Craggs, M. E. Haine & J. M. Meek. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 5, pp. 963–976.) The factors governing the design of rotary and triggered spark-gaps capable of passing impulses of high peak power are described. The influence of different gas fillings and electrode materials for sealed spark-gaps is shown, together with the variations in performance obtained with different gas pressures.

621.396.662 **834**

An Electron-Ray Tuning Indicator for Frequency Modulation.—F. M. Bailey. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1947, Vol. 35, No. 10, pp. 1158–1160.) The indicator has a translucent fluorescent target, a rectangular divided pattern and adequate sensitivity for both a.m. and f.m. detectors without additional amplifiers.

621.396.682 : 621.316.722.1.076.7 **835**

Stabilizing Direct-Voltage Supplies.—W. H. P. Leslie. (*Wireless Engr*, Oct. 1947, Vol. 24, No. 289, p. 309.) Comment on 4045 of 1947 (Hughes). The usefulness of the calculation of the performance of voltage regulating valves is disputed because of the large variation in regulated voltage and control obtained with different individual valves, and with the same valves after different periods of use.

TELEVISION AND PHOTOTELEGRAPHY

621.397.331.2 **836**

Video Storage by Secondary Emission from Simple Mosaics.—R. A. McConnell. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, pp. 1258–1264.) A qualitative investigation of the storage properties of mosaics in iconoscope tubes.

621.397.331.2 : 538.691 **837**

The Motion of Electrons subject to Forces transverse to a Uniform Magnetic Field.—Weimer & Rose. (*See* 709.)

621.397.5 : 535.88 **838**

A New French System for Large-Screen Television.—P. Hémardinquer. (*J. Televis. Soc.*, March 1947, Vol. 5, No. 1, pp. 28–30.) Translated from the French. The Toulon screen is composed of 276 480 movable vane electrodes, each 8 × 6 mm, made of thin Al foil. They are arranged side by side in rows and attached to a series of brass rods. The screen is illuminated by an external source and each vane has a matt surface which diffuses the rays within an angle of about 20°. When the vane is normal to the eye the screen surface appears white, changing through grey to black as the vane is tilted. It is possible to obtain a linear relation between the angle of tilt and the light intensity. Each vane is at earth potential and is situated close to a modulating electrode, the potential of which controls the inclination of the vane and hence the light intensity. See also 1609 of 1947.

621.397.5 : 621.396.67 **839**

Biconical Television Antenna.—(*Elect. Engng, N.Y.*, Oct. 1947, Vol. 66, No. 10, p. 1011.) Will pick up local programmes from mobile units without being aimed at the units. Two Al cones of wide vertical angle have their vertices facing each other and joined by a vertical dipole. A photograph is included.

621.397.5 : 621.396.67 **840**

WTTG TV Antennas.—Hamilton & Olsen. (*See* 653.)

621.397.5 : 621.396.97 **841**

The Television Outside Broadcast Service.—T. H. Bridgewater. (*J. Televis. Soc.*, March 1947, Vol. 5, No. 1, pp. 13–21. Discussion, pp. 21–22.) A general description of the equipment used and the organization and methods for relaying the signals to Alexandra Palace for transmission. The apparatus is transported in 6 vehicles containing respectively scanner, transmitter, aerial, generator, Emitron tubes and subsidiary apparatus. The sound link is normally by standard telephone line and the vision by either radio or special cable link. See also 3685 of 1947.

621.397.5 : 679.5 : 535.316/.317 **842**

British [plastic] **Lenses combine Molding, Casting.**—D. Starkie. (*Mod. Plast.*, Oct. 1947, Vol. 25, No. 2, pp. 107–109.) A general survey of the uses and methods of manufacture of plastic mirrors and lenses. See also *Nature, Lond.*, 19th July 1947, Vol. 160, No. 4055, p. 99.

621.397.5 : 778.5 **843**

The Film in Relation to Television.—M. Cooper. (*J. Televis. Soc.*, March 1947, Vol. 5, No. 1, pp. 3–9, 22.)

621.397.62 : 621.317.79 : 621.396.615 **844**

Television Signal Generator.—Fisher. (*See* 775.)

621.397.62.001.4 : 621.317.79 **845**

Television Receiver Production Test Equipment.—Bauer. (*See* 780.)

621.397.743 **846**

Interconnecting Facilities for Television Broadcasting.—W. E. Bloecker. (*Electronics*, Nov. 1947, Vol. 20, No. 11, pp. 102–107.) Video facilities now available, or to be completed by 1950, include a 12 000-mile nation-wide system using coaxial cable, local networks employing shielded-pair telephone cables, and microwave radio circuits. Provision is made for direct connection of broadcasters' equipment to shielded-pair systems.

TRANSMISSION

621.316.726.029.64 : 621.396.65.029.64 **847**

Simplified Microwave A.F.C. : Part 1.—F. A. Jenks. (*Electronics*, Nov. 1947, Vol. 20, No. 11, pp. 120–125.) The a.f.c. carrier is coupled to a cavity resonator with a resonant-frequency sweep of given rate. The resonator detector registers a phase-reversed, variable-magnitude voltage of the fundamental sweep frequency, this voltage being zero when resonator and carrier frequencies coincide. In the mechanical a.f.c. system this output, after amplification, is applied directly to the control winding of a 2-phase motor, the fixed winding being energized from the frequency sweeping source. For electronic a.f.c. the motor is replaced by a phase detector, whose output is fed to the reflector circuit of a klystron.

A combination of these two systems with push-button and automatic scanning can be used for a 3 000-Mc/s radio relay system that remains within 200 kc/s of the assigned frequency. This will be described later.

621.396.61/.62 **848**

A Lightweight Mobile Transmitter-Receiver.—(*Engineer, Lond.*, 10th Oct. 1947, Vol. 184, No. 4785, p. 349.) For R/T communication between fixed and mobile units. Forced ventilation makes possible a compact design measuring 18 inches × 8 inches × 8 inches and weighing 35 lb. The transmitter has a r.f. power output of 20 W at about 100 Mc/s. The unit can be used as a public address amplifier. The receiver is a double superheterodyne using miniature valves throughout. Centre frequency stability better than 0.001% is claimed. The set is suitable for 6-V or 12-V battery input.

621.396.61 : 621.316.3 **849**

Versatile Control Systems for Transmitters.—L. Kanoy. (*QST*, Oct. 1947, Vol. 31, No. 10, pp. 58–59.) Discussion of power-switching circuit arrangements to provide convenience and safety for operator and equipment.

621.396.61 : 621.396.712 **850**

Collins F.M. Broadcast Transmitters.—N. H. Hale. (*F.M. & Televis.*, Oct. 1947, Vol. 7, No. 10, pp. 32–34.) The transmitter consists of a basic phasitron modulator unit with an output of 250 W or 1 kW, and amplifiers of 3, 10, 25 and 50 kW. Great emphasis has been put upon simplicity, ruggedness and accessibility. A circuit diagram is given of the 250-W modulator followed by the 3-kW amplifier ; the 1-kW modulator differs only in the output valves. Grounded-grid circuits are used in the other amplifiers, which are driven by the 3-kW amplifier. Separate circuit breakers are provided for the various units. Motor drives are used for tuning adjustments.

621.396.61.029.62 **851**

The Lazy Kilowatt.—L. LeKashman. (*CQ*, July 1946, Vol. 2, No. 7, pp. 11–15 . . 55.) An inexpensive amateur transmitter for R/T or c.w. which can be built without special workshop facilities. Low driving requirements eliminate the exciter problem. The final amplifier uses Eimac 4-250A tetrodes.

621.396.61.029.62 **852**

Practical Crystal Control for 144-Mc/s Mobile Work.—P. H. Hertzler. (*QST*, Oct. 1947, Vol. 31, No. 10, pp. 54–55.) The number of valves, and consequently the current drain on the power supply, is greatly reduced by crystal control of transmitters. Details are given of a transmitter using a 48-Mc/s crystal and a 6C4 triode oscillator with a tripler stage. Power is supplied by a conventional vibrator.

621.396.61.029.62 : 621.396.96 **853**

The C.H. [Chain-Home] **Radiolocation Transmitters.**—J. M. Dodds & J. H. Ludlow. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 6, pp. 1007–1015.) A general description of the development work leading up to the final design of the C.H. type transmitters for the Air Ministry. The original specification called for at least 200 kW of r.f. pulse energy on four preselected frequencies in the 20–55 Mc/s band, the r.f. pulses to be timed to $\pm 2\ \mu$s relative to zero phase of the 50-c/s supply. The final design produced an average of 750 kW with a stability of ± 10 c/s at 20 Mc/s, the variations of the timing of the pulses being less than 0.025 μs. The original combination of master oscillator, doubler and power amplifier was abandoned in favour of a pulsed self-oscillator, to prevent radiation during quiescent periods. Thyratrons of special design were used in the modulator stages.

621.396.61.029.62 : 621.396.96 **854**

Mobile Metre-Wave Ground Radar Transmitters for Warning and Location of Aircraft.—R. V. Whelpton. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 6, pp. 1027–1042.) A record of the development of R.A.F. p.m. transmitters for the 10–200 Mc/s band, with a detailed account of the circuits used in M.B. (Mobile Base) and C.H.L./G.C.I. (Chain Home Low and Ground-Controlled Interception) transmitters. Details are also given of early prototype transmitters and the development of suitable valves is reviewed.

The M.B.1 transmitter produced 10- or 20-μs pulses, with a peak power of 25–40 kW, on λ 7–13 m, while the M.B.2 gave 5–30-μs pulses on λ 6–15 m, with a peak power of 400 kW and a recurrence frequency of 50, 25 or $12\frac{1}{2}$ pulses/sec.

The C.H.L./G.C.I. transmitter operated at about 200 Mc/s, with pulses of 4–6 μs, peak power 80 kW and a recurrence frequency between 350 and 900 pulses/sec.

621.396.61.029.63 : 621.396.931 **855**

Transmitter for the Citizens Radio Service: Part 1.—W. C. Hollis. (*Electronics*, Nov. 1947, Vol. 20, No. 11, pp. 84–89.) Full constructional and design details of a portable f.m. unit with output $\frac{1}{4}$ W at 465 Mc/s. The ph.m. of 28.6° produces a frequency deviation of 16 kc/s at a modulation frequency of 300 c/s and noise reduction is sufficient provided the maximum modulation frequency is restricted to 3 000 c/s. The expected optical path range is 25 miles with 20 db carrier/noise ratio.

621.396.61.029.63 : 621.396.96 **856**

The Development of Decimetre-Wave Radar Transmitters for the Royal Air Force.—T. S. England. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 6, pp. 1016–1026.) A review of decimetre-wave transmitter developments at the establishment now known as the Telecommunications Research Establishment, during the period 1940–1945. The discussion is limited to wavelengths in the region of 50 cm. Urgent operational requirements dictated the whole progress of the work, which was first concentrated on the development of suitable valves, the NT99 being the outcome. A pair of these valves gave an output of about 100 kW. Various transmitter and modulator circuits are given, including those used in A.M.E.S. Type 11 [mobile ground radar] and Type 16 [fixed fighter direction stations]. Details are given of suitable common-aerial switches using the VI507 argon spark gap. The development of the CV288, a grounded-grid triode capable of 50 kW with a grid drive of 12 kW, made possible the use of power amplifier technique in the 50-cm band.

621.396.61.029.64 : 621.316.726 **857**

Frequency Instability of Pulsed Transmitters with Long Wave Guides.—B. W. Lythall. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 6, pp. 1081–1089.) The frequency of oscillation, frequency instability and its elimination are considered for a pulsed magnetron, loaded with a long mismatched feeder. The frequency variations during the transient state are discussed qualitatively, and details of experimental results are given.

621.396.615.141.2 : 530.19 **858**

Scalar and Vector Potential Treatment.—Richards. (*See* 702.)

621.396.619.13 **859**

Variation of Bandwidth with Modulation Index in Frequency Modulation.—M. S. Corrington. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1947, Vol. 35, No. 10, pp. 1013–1020.) Equations are derived for the carrier and side-frequency amplitudes obtained in f.m. of a carrier wave by a complex audio signal. Sinusoidal, square, rectangular and triangular modulation are considered. For large modulation indices when the deviation is much greater than the repetition rate, the bandwidth is only slightly greater than the actual variation in frequency. For small indices, the bandwidth may be several times the actual frequency deviation. Curves are given for indices from 0.1 to 10 000. For complex modulation, the total bandwidth can be estimated by computing the bandwidth that would be required by each separate a.f. component, and adding the results.

621.396.619.13 : 621.316.726 **860**

Center-Frequency-Stabilized Frequency-Modulation System.—E. M. Ostlund, A. R. Vallarino & M. Silver. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1947, Vol. 35, No. 10, pp. 1144–1149.) Frequency division of part of the oscillator output by 256 reduces the modulation swing to less than $\pm 24°$. The phase of the resulting oscillation is compared with that of an oscillation of the same frequency, derived from a crystal source, using a balanced phase detector whose output is fed back to the reactance valve controlling the master oscillator. Any phase difference produces a correcting voltage which acts so as to maintain synchronism with the reference frequency.

621.396.619.16 : 621.396.813 **861**

Distortion in Pulse-Duration Modulation.—E. R. Kretzmer. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, pp. 1230–1235.) " Pulse-duration modulation inherently gives rise to a certain amount of audio distortion. The analysis presented in this paper relates the distortion to system parameters. The method of analysis is exact, and therefore correct for any degree of modulation. It does not, however, lend itself to periodic sampling. The results are applied to three specific cases."

621.396.619.16 : 621.396.96 **862**

Time Modulation.—B. Chance. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1947, Vol. 35, No. 10, pp. 1039–1044.) A brief review of basic processes. Representative practical circuits are given. In military applications such as radar range-finding, high precision is required and many methods for achieving a linearity and stability of 1 part in 10^4 are available.

621.396.619.23 **863**

Hard-Valve Pulse Modulators for Experimental Use in the Laboratory.—R. H. Johnson. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 6, pp. 1043–1057.) The general nature of modulation circuits, their technique and practical limitations are briefly reviewed. A comprehensive discussion of hard-valve modulators is then given, with details of the design of each stage and the manner in which load requirements are met. Several different types of driver circuit are described and their relative advantages and disadvantages are discussed. Methods of measurement of the length, current, voltage, and repetition rate of the pulses are also considered. The wide range of applications of a laboratory modulator requires great flexibility in the design. A detailed description is given of two hard-valve modulators in which the pulse length can be varied from 0.2 to 2 μs, the repetition frequency from zero to 5 000 pulses/sec and with maximum peak power of 1 MW.

621.396.619.23 : 621.396.96 **864**

Some Developments in High-Power Modulators for Radar.—K. J. R. Wilkinson. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 6, pp. 1090–1112.) Modulators which depend upon the discharge of a pulse-shaping network depend also upon the related but separate action of charging. The method of charging from a d.c. source, using a series thyratron, is given. The principles and theory of alternator charging are described for thyratron and spark modulators, and the effect of overswing in the modulator is discussed. A.c. rectifier charging is considered and compared with the alternator method. The use of cable circuits to generate higher pulse-voltages than are possible by the discharge of a single pulse-shaping network is discussed. The action and behaviour of the Blumlein cable circuit, and of the Marx connection of cables, with its auxiliary charging problem, are considered. Two forms of 4-electrode air-blown triggered spark-gaps are introduced, together with an account of the mechanisms of their triggering and of jitter. A theory is outlined for the series peaking transformer. A short description is given of certain complete modulators incorporating the above features.

VALVES AND THERMIONICS

621.385.032.3 **865**

Electrode Dissipation at Ultra-High Frequencies.—Z. W. Wilchinsky. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1947, Vol. 35, No. 10, pp. 1155–1157.) A simple method of measurement, with results for a 2C43 triode oscillator.

621.385.1 **866**

Improvements in Small Tubes.—(*Electronics*, Nov. 1947, Vol. 20, No. 11, pp. 144..182.) A short account of some subminiature valves now in production, with brief mention of an experimental valve recently produced in the valve laboratory of the National Bureau of Standards.

621.385.1 **867**

Tube Production Techniques.—V. G. Jarman. (*Electronics*, Oct. 1947, Vol. 20, No. 10, pp. 160..164.) Brief description of a new type of electrode holder on bench welders and an adjustment fixture for examining the alignment of grid laterals.

621.385.1 **868**

Advantages of Space-Charge-Grid Output Tubes.—N. C. Pickering. (*Audio Engng, N.Y.*, Oct. 1947, Vol. 31, No. 9, pp. 20–21, 45.) Long summary of I.R.E. paper. Pentodes and beam-power valves are easier to drive than triodes, but have intrinsically higher distortion. The space-charge-grid valve combines the advantages of both. Graphs showing the comparative performance of all three types are given.

621.385.1 : 003.62 **869**

Letter Symbols for Electronic Valves. [Book Notice]—British Standards Institution, London, 1947, 2s. (*Brit. Stand. Instn Mon. Inform. Sheet*, Oct. 1947, p. 2.) "The letter symbols laid down in this standard apply to electrodes and other components of electronic valves, designations of different types of valves and electrical quantities in connection with valve technique. They are intended for use by valve manufacturers and users and in technical literature generally."

621.385.1.012 : 621.317.755 **870**

Producing Tube Curves on an Oscilloscope.—Webking. (*See* 772.)

621.385.1.029.63/.64 + 621.396.615.14 **871**

Transmitting Valves for Communication on Short Wavelengths.—W. H. Aldous. (*J. Brit. Instn Radio Engrs*, Sept. 1947, Vol. 7, No. 5, pp. 167–181.) The characteristics of space-charge-control, velocity-modulation, magnetron and travelling-wave types of valve are reviewed. New triodes for use up to 3 700 Mc/s and a new modulator are described briefly.

621.385.1.032.216 : 537.533.1 : 537.583 **872**

Influence of Space Charge on Thermionic Emission Velocities.—O. Klemperer. (*Proc. roy. Soc. A*, 12th Aug. 1947, Vol. 190, No. 1022, pp. 376–393.) Apparatus and experimental methods are described for obtaining the distribution of tangential velocity components of the electron emission from oxide cathodes under space charge conditions. Results show the distribution to be either Maxwellian or to consist of discrete velocity groups, some of which include large numbers of electrons having velocities far in excess of that expected from the cathode temperature. This splitting into groups is explained by space charge oscillation phenomena, the wavelength of which is compared with that obtained from measurements of the average angular distance of the elementary velocity groups.

621.385.3 **873**

A New Miniature Double Triode.—G. C. Dalman. (*Bell Lab. Rec.*, Sept. 1947, Vol. 25, No. 9, pp. 325–329.) Describes the manufacture and design of the 396A (2C51) double triode. It has a 9-pin base, high transconductance and very low interelectrode capacitance. Characteristic curves and figures are given.

621.385.3 : 621.396.615.14 **874**

Triodes for Very Short Waves — Oscillators.—Bell, Gavin, James & Warren. (*See* 683.)

621.385.3 : 621.396.822 **875**

Electrical Noise Generators.—J. D. Cobine & J. R. Curry. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1947, Vol. 35, No. 9, pp. 875–879.) The noise source consists of a miniature gas triode placed in a transverse magnetic field which not only increases the level of the h.f. noise but also eliminates undesirable oscillations. The dependence of the noise spectrum upon the magnitudes of the magnetic field, the load resistance and the anode current is shown. The noise spectrum falls off rapidly at frequencies over 700 kc/s, but it is found that by the use of suitable equalizing circuits in the output amplifier a substantially level noise spectrum up to 5 Mc/s may be obtained. The circuits of two wide-band noise generators having ranges of 0.1–2.5 Mc/s and 0.1–5 Mc/s are given. See also 3487 of 1946 (Cobine & Gallagher) and 3722 of 1947 (Johnson).

621.385.3.029.62 **876**

Triodes for 3- and 10-Kilowatt Frequency-Modulated Transmitters.—P. I. Corbell, Jr, & H. R. Jacobus. (*Elect. Commun.*, June 1947, Vol. 24, No. 2, pp. 187–191.) Complete discussion of low and medium power transmitting triodes 7C26 and 7C27 for use in the f.m. broadcasting band 88–108 Mc/s. See also 877 below.

621.385.3.029.63 **877**

Medium-Power Triode for 600 Megacycles.—S. Frankel, J. J. Glauber & J. P. Wallenstein. (*Elect. Commun.*, June 1947, Vol. 24, No. 2, pp. 179–186.) Reprint of 1635 of 1947. The valves described are known as L600E and 6C22; see also 2288 of 1947 (Glauber) and 876 above.

621.385.3.029.64 **878**

Transadmittance and Input Conductance of a Lighthouse Triode at 3 000 Megacycles.—N. T. Lavoo. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, pp. 1248–1251.) Measurements at 3 000 Mc/s indicate that for transit-angles of 10 radians the transadmittance falls to about 20% of its l.f. value. The conductance also falls, but never becomes negative as transit-time theory would suggest.

621.385.38 : 621.396.96 **879**

The Development of Mercury-Vapour Thyratrons for Radar Modulator Service.—H. de B. Knight & L. Herbert. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 5, pp. 949–962.) The design of thyratrons to meet Service requirements is reviewed, with special reference to the design of electrodes to reduce disintegration of the cathode by bombardment by positive ions, anode erosion due to sputtering, and deposition of sputtered material on the control grid, all of which occur under the required operating conditions of high peak current and rapid build-up. The effects of the cathode operating temperature, of Hg vapour condensation temperature, and of ionization and deionization of the Hg vapour are also considered, and experimental results are given showing the effect of these factors on the performance of the thyratrons.

621.385.4.029.64 **880**

Space-Charge and Transit-Time Effects on Signal and Noise in Microwave Tetrodes.—L. C. Peterson. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, pp. 1264–1272.) A theoretical analysis of conditions in the grid-screen region of long-transit-angle microwave tetrodes, assuming the electron stream velocity to be single-valued. A minimum noise figure can be obtained by proper adjustment of the space charge in the grid-screen region, so that the noise produced by random cathode emission is cancelled.

621.385.831 **881**

Beam-Deflection Control for Amplifier Tubes.—G. R. Kilgore. (*RCA Rev.*, Sept. 1947, Vol. 8, No. 3, pp. 480–505.) The basic principles involved in obtaining high transconductance are discussed. With conventional grid control, a limitation is set by the ratio of transconductance to anode current, which in practice seldom exceeds 2 μmho/μA.

Deflection control, coupled with the concept that the above ratio is a function of current density rather than beam current, offers possibilities of obtaining substantial transconductance with low capacitance and low beam currents, and with a very high ratio of transconductance to anode current. Expressions are derived for the ultimate transconductance at both low and high frequencies. Elementary electron optics and the design of a simple beam-deflecting gun are discussed.

It is found experimentally that useful values of transconductance with low capacitance and low current can be obtained with a simple deflection gun combining focusing and deflection. This type of control is ideally suited for use with a high-gain secondary emission multiplier to obtain very high transconductance without excessive capacitance, thus making possible a valve with a bandwidth figure of merit many times greater than for conventional valves.

Confirmation of some of the properties of deflection control in agreement with the analysis has already been obtained in experimental amplifier valves combining beam deflection control and a multi-stage secondary-emission multiplier.

621.385.831.029.63/.64 **882**

Grounded-Grid Amplifier Valves for Very Short Waves.—J. Foster. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 5, pp. 868–874. Discussion, *ibid.*, Part III, 1947, Vol. 94, No. 31, pp. 364–368.) A theory of the common-grid earthed-grid amplifier, commonly called the grounded-grid amplifier, for medium transit angles is presented, showing the advantages this valve possesses over the earthed-cathode amplifier. A description of a range of valves using disk seals is given and their performance indicated, mention being made of the circuit advantages offered by the use of disk seals in valves. The results obtained on experimental valves are presented, and for signal/noise ratio improvement the probable upper limit of 2 000 Mc/s with present techniques is suggested, 5 000 Mc/s being the probable limit for oscillators.

"The two important problems awaiting theoretical attack are 'total-emission damping' and high-frequency slope."

621.385.832 **883**

The Cyclophon: A Multipurpose Electronic Commutator Tube.—D. D. Grieg, J. J. Glauber & S. Moskowitz. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, pp. 1251–1257.) The cyclophon is a conventional c.r. tube whose screen is replaced by 25 positively-charged target-anodes or 'dynodes' arranged uniformly in a circle and located opposite sector-shaped holes in a metal aperture-plate a short distance away. A circular timebase applied to the tube causes each dynode to be energized in turn by the electron beam, which may be regarded as the rotating arm of a multipole switch. The current obtained from each dynode may be increased to about 30 mA by secondary emission if the potential of the aperture plate is raised above that of the dynodes. Details of design, construction, and characteristics are given, and cross-talk between dynodes is analysed. Applications include modulation and demodulation in pulse-time multiplex systems, pulse generation, delay and phasing, frequency multiplication and voltage dividing. See also 3657 of 1947 (Altman & Dyer).

621.385.832 : 535.371.07 **884**

An Examination of Cathode-Ray-Tube Screen Characteristics.—R. G. Hopkinson. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 5, pp. 779–794. Discussion, p. 832.) An optical analogy to the operation of a c.r. tube screen leads to the measurement of the total transmission of the screen; this provides a sensitive indication of the powder concentration for maximum luminous efficiency. The direct transmission measures the screen coverage and texture and the effect of the processing method on the texture. The effects of different screen preparations upon colour and efficiency are determined by means of a demountable c.r. tube which enables a range of phosphors to be scanned at various screen potentials and beam currents. An appendix covers the routine measurement of screen transmission and the subjective assessment of screen texture.

621.385.832 : 535.371.07 : 621.396.96 **885**

Cathode-Ray-Tube Screens for Radar.—G. F. J. Garlick, S. T. Henderson & R. Puleston. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 5, pp. 815–821. Discussion, p. 832.) Theoretical and experimental studies show that afterglow is a complex function of the excitation conditions. Two types of screen-testing apparatus are described which simulate the operational behaviour of p.p.i. displays, and results are given for H_2S. Factors affecting the operator's response are considered and some details given of the screen materials used.

621.385.832 : 535.371.07 : 778 **886**

The Photography of Cathode-Ray-Tube Traces.—R. G. Hopkinson. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 5, pp. 808–814. Discussion, p. 832.) The actinic properties of some luminescent materials under c.r. excitation are tabulated and their spectral distributions are shown. The recording of fast transients is studied, the results being presented in the form of an exposure table. The effects of changes in anode voltage, beam current and focus adjustment are noted.

621.385.832 : 621.396.96 **887**

War-Time Developments in Cathode-Ray Tubes for Radar.—L. C. Jesty, H. Moss & R. Puleston. (*J. Instn elect. Engrs*, Part III, Sept. 1947, Vol. 94, No. 31, pp. 344–345.) Discussion on 2983 of 1947.

621.385.832 : 621.396.96 **888**

The Skiatron or Dark-Trace Tube.—P. G. R. King & J. F. Gittins. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 5, pp. 822–831. Discussion, p. 832.) For another description of the skiatron see 2404 of 1946 (King : Watson).

621.385.832.087.3 : 621.396.96 **889**

Visibility of Cathode-Ray-Tube Traces in Radar Displays.—R. G. Hopkinson. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 5, pp. 795–807. Discussion, p. 832.) Apparatus is described for the measurement of signals of different shapes and sizes seen against uniform and non-uniform backgrounds; the results are applied to the use of light filters to improve visibility. The visual persistence effects associated with p.p.i. displays were examined experimentally and a display was redesigned to give better discrimination between adjacent signals.

621.396.615.141.2 **890**

The Cavity Magnetron.—H. A. H. Boot & J. T. Randall. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 5, pp. 928–938.) An account of the development from the first demountable 6-resonator model which showed that such an oscillator was possible. Pulse models for various frequencies which were then made showed that the principle of operation was very general. Experiments on a cold Al-cathode valve showed that secondary emission was an important factor in improving the efficiency. Frequency jumping caused by a change of mode of the oscillations resulted in the introduction of strapping, in which alternate anode segments are joined by metal bridges. Finally, theoretical work on mode selection and the effect of loading on mode change behaviour is reviewed.

621.396.615.141.2 **891**

The High-Power Pulsed Magnetron: A Review of Early Developments.—E. C. S. Megaw. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 5, pp. 977–984.) An account of the progressive steps leading to the development in June 1940 of the first 10-cm pulsed magnetron. The multiresonator system developed by Boot & Randall (890 above) and the large oxide cathode developed by Gutton in Paris, were combined in a construction designed for use with a small permanent magnet, and produced a system suitable for airborne work. Systematic development of design procedure based on pre-war work was an important contribution to the great increase of pulse output power obtained between June and December 1940.

621.396.615.141.2 : 621.396.96 **892**

The High-Power Pulsed Magnetron. Development and Design for Radar Applications.—W. E. Willshaw, L. Rushforth, A. G. Stainsby, R. Latham, A. W. Balls & A. H. King. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 5, pp. 985–1005.)

An account of the development of the multi-resonator magnetron from the first manufactured designs to the latest models. Details of the construction of early valves are followed by an account of strapping, strap breaks, wavelength presetting and the difficulties encountered. The electronic theory is given briefly in calculating the operating performance. Design problems for λ 3 cm, constructional techniques and production line test equipment are discussed. Examples of valves for the highest output powers on λ 10 cm and λ 3 cm are given and mode change problems are considered. The design of cathodes presents unusual problems which are covered in detail. An appendix deals with some aspects of magnetron circuit design, using equivalent circuits.

621.396.615.142 **893**

Principles of Velocity Modulation.—(*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 5, pp. 875–917.) Part 1: Single-Transit Velocity-Modulated Oscillators, by J. H. Fremlin. An introduction covering resonator and coaxial-line oscillators and an explanation, without detailed proof, of the physical meaning of starting current, energy interchange between the beam and the resonator, averaging of current over the beam cross-section, the calculation of circuit conductance, and the dependence of starting current on the drift tube length and on the beam voltage. The importance of starting current in determining the performance is shown and the choice of optimum mechanical dimensions is considered with reference to the design of oscillators with as little recourse to experiment as possible.

Part 2: Small-Amplitude Theory and Starting Current, by A. W. Gent. " This section gives the theory of the operation of v.-m. valves on the assumption that the h.f. voltage swing across the gaps is very small compared with the resonator voltage. From the expression for the exit velocity of an electron from a gap as a power series in the depth of modulation, and the expression for the time spent in traversing a gap, the energy transfer between the electron beam and the resonator is found. The general expression for the efficiency of a tube with n gaps is given. This leads to the equations for the starting current, and to the possibility and advantages of optimizing tubes for minimum starting current."

Part 3: Gap Efficiency Factors, by D. P. R. Petrie. " The nature and properties of the gap efficiency factors β and γ are discussed, β being a measure of the efficiency of a gap in effecting energy interchange between the electron beam and the high-frequency field, and γ being proportional to the derivative of this efficiency with respect to entrance velocity.

" An important theorem is proved that the law of variation of β across a parallel beam is independent of the potential distribution in the gap, and hence the same for all gaps, but depends on the type of symmetry. This enables the general expression for the beam efficiency to be averaged across the beam.

" β, γ and the average beam efficiency are evaluated for types of gap in common use and the results applied to the particular case of the coaxial-line oscillator."

Part 4: Power Output and Efficiency of Velocity-Modulated Valves, by P. J. Wallis. This paper obtains and discusses an approximate formula for the efficiency of velocity-modulation valves when the voltage modulation is no longer small. For both theoretical and experimental reasons, the bunching formula given previously by Webster has to be modified by including the gap-efficiency factor β, although this still neglects the effect of the variation in the speed of the electron bunches due to the voltage modulation α. It is also necessary to take into account the absorption of power from a uniform electron stream in a single gap. The approximate formula is compared with exact results obtained by numerical integration for the case of infinitely-short gaps, and by means of a differential analyser for one particular wide gap.

" Several possible extensions of the approximate formula are discussed. The final sections use the formula to deduce the power delivered into the useful load and show how valves can be designed for maximum power output."

Part 5: Electronic Frequency Control of Oscillators, by S. G. Tomlin. " A physical explanation of the fact that the frequency of a velocity-modulated oscillator may be varied by adjustment of the electron beam velocity is given, and the problem is treated by calculating the currents induced in the modulating gaps of the resonators. In this way it is shown that the electron beam effectively connects a complex admittance across the modulating gaps. The real part of this admittance may be negative, in which case oscillations may be maintained at a frequency partly determined by the beam susceptance.

" The theory is applied in detail to the case of a single-transit double-gap oscillator of the coaxial line type and the conditions for maximum frequency change are obtained.

" Some consideration of reflex oscillators is given, and the large-signal theory of electronic frequency control is discussed briefly."

621.396.615.142 **894**

Elementary Theory of Velocity-Modulation Oscillators.—N. C. Barford & M. Bowman-Manifold. (*J. Instn elect. Engrs*, Part III, Sept. 1947, Vol. 94, No. 31, pp. 302–314.) " A first-order theory of velocity-modulation oscillators is developed, leading to an expression for their efficiency which takes into account the resonator losses and the corrections due to beam damping. The bunching properties of various field distributions are investigated and formulae are given which enable them to be calculated in all cases on the assumption that space-charge effects may be neglected."

621.396.615.142 **895**

Velocity-Modulation Valves.—L. F. Broadway, C. J. Milner, D. R. Petrie, W. J. Scott & G. P. Wright. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 5, pp. 855–867. Discussion, *ibid.*, Part III, 1947, Vol. 94, No. 31, pp. 359–363.) A detailed survey of the war-time development, application and construction of high power c.w. buncher-catcher klystrons including (*a*) type CV80, which has an output of 100–300 W at wavelengths of about 7 cm, (*b*) reflection klystrons for λ 7 cm and λ 3 cm with outputs of the order of 100 mW, which are suitable for electronic frequency control, (*c*) wide-frequency-range coaxial-line oscillators, such as type CV234 covering the range λ 8–16 cm and type CV288 covering λ 6–7 cm, and (*d*) a wide-tuning-range reflector oscillator developed for λ 5–10 cm and λ 7–14 cm, which uses a cavity with a non-contact plunger developed from the λ/4 line filter.

621.396.615.142 : 621.396.611.4 **896**

Loading of Resonant Cavities by Electron Beams.—Abraham. (*See* 682.)

621.396.615.142.029.64 **897**

The CV35 — A Velocity-Modulation Reflection Oscillator for Wavelengths of about 10 cm.—A. F. Pearce & B. J. Mayo. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 5, pp. 918–927.) A description of a low power c.w. oscillator developed in 1940–41. The resonator is of the disk-seal type, tuning being obtained by screw plungers. " Dimensional details and characteristics are given, as well as a short account of the experimental development of the valve. The factors affecting the performance are mentioned and the efficiency and stability discussed on the basis of the first order theory of Barford & Manifold [894 above]. Finally the theoretical efficiency is calculated and seen to be in good agreement with the observed value."

621.396.615.142.2 **898**

Transit-Time Effect in Klystron Gaps.—H. B. Phillips & L. A. Ware. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1947, Vol. 35, No. 10, pp. 1076–1079.) A graphical method of calculation gives the effect of grid spacing on the so-called ideal drift distance S. For a modulation depth of 0.5, S increases by 47% as the grid spacing is varied from 0 to 2 mm for an accelerating voltage of 1 200 V and a frequency of 3 000 Mc/s. See also 1355 of 1942 (Kompfner).

621.396.822 : 621.385 **899**

Noise in Electrometer Tubes.—A. T. Forrester. (*Phys. Rev.*, 15th Oct. 1947, Vol. 72, No. 8, p. 747.) Summary of Amer. Phys. Soc. paper. North's theory (769 of 1941) of noise in valves having positive grids, when applied to a particular electrometer valve, gives an equivalent noise resistance 11.4 times the value obtained from the usual triode term $3/g_m$. An approximation to the noise may be obtained by assuming the anode-current fluctuations to be temperature-limited shot noise.

MISCELLANEOUS

389.6 : [53.081 + 621.3.081 **900**

Standardization.—P. Good. (*Beama J.*, Oct. 1947, Vol. 54, No. 124, pp. 337–340.) An outline of the basic principles underlying industrial standardization as applied to all industries, with a record of some historical steps taken by the I.E.E. to encourage the development of standardization.

537.311.2 **901**

Ohm and His Law.—G.W.O.H. (*Wireless Engr*, Oct. 1947, Vol. 24, No. 289, pp. 284–287.) Biography of Georg Simon Ohm, with an account of his experiments and description of his papers published in 1826 first formulating the laws of electrical conduction. See also 1063 and 2393 of 1947.

62 : 371.3 **902**

Postwar [engineering] **Curriculum Emphasis.**—O. J. M. Smith. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1947, Vol. 35, No. 11, pp. 1346–1348.)

621.3 "17" **903**

The Frog that led to Electrical Science.—E. Hardy. (*Beama J.*, Oct. 1947, Vol. 54, No. 124, pp. 357–358.) The frog was intended for Professor Galvani's soup ; its leg muscles were brought into action when his wife touched them with a scalpel which had been accidentally charged electrically.

621.396 **904**

British Research in the Radio Field.—(*J. Instn elect. Engrs*, Part I, Nov. 1947, Vol. 94, No. 83, pp. 502–508.) Summaries of this report by the Research Committee of the Institution of Electrical Engineers were noted in 320 of January. It is recommended that increased financial support should be given to academic laboratories, that industrial research programmes should be planned on a long-term basis, and that new buildings for research purposes should be erected. Various suggestions are made with the object of encouraging potential research leaders to undertake radio research ; a much wider exchange of personnel between universities, industry and Government establishments is recommended. No attempts at rigid coordination should be made, but research workers should be enabled to form a ready assessment of work already in hand and of the results obtained. For this purpose, informal contacts between heads of research establishments should continue and colloquia and conferences on research subjects should be held. For the coordination of advanced development, the setting up of Sir Stanley Angwin's Committee on Fundamental Research in Telecommunication is welcomed, and the work of the Radio Components Research and Development Committee of the Ministry of Supply should continue. The vital importance of the dissemination of research results inspires the recommendation that an agency generally resembling the Central Radio Bureau should be set up to serve as a focal point for the dissemination of details of work proceeding in academic, Service and industrial laboratories. Finally, the importance of timely application of research results is stressed.

621.396"1946/1947" **905**

F.C.C.'s Review of Radio Progress [1946–1947].—C. R. Denny, Jr. (*F.M. & Televis.*, Oct. 1947, Vol. 7, No. 10, pp. 19–21 . . 51.) Report of address to the National Association of Broadcasters at Atlantic City by the F.C.C. Chairman.

621.3 : 42-3 = 3 = 4 **906**

Technical Dictionary. [Book Review]—H. Thali. Distributor, W. S. Heinman, New York. 1946, 275 pp., $6.25. (*Electronics*, Oct. 1947, Vol. 20, No. 10, p. 261.) English terms are in alphabetical order ; each is followed by its German and French equivalents. Coverage of English radio and electronic terms is 'commendably complete' ; most-used terms of acoustics, illumination, mathematics, optics and related fields are also given.

621.38/.39 **907**

Electronic Engineering Principles. [Book Review]—J. D. Ryder. Prentice-Hall, New York, 1947, 397 pp., $6.65. (*Tele-Tech*, Sept. 1947, Vol. 6, No. 9, p. 94.) " . . . a book that covers the fundamentals of electron tube operation that will serve either as a text or reference on this subject for either engineering students or engineers in the field."

ABSTRACTS and REFERENCES

Compiled by the Radio Research Board and published by arrangement with the Department of Scientific and Industrial Research

The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to the World List practice.

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ACOUSTICS AND AUDIO FREQUENCIES

016 : 534 **908**

References to Contemporary Papers on Acoustics.—A. Taber Jones. (*J. acoust. Soc. Amer.*, Sept. 1947, Vol. 19, No. 5, pp. 926–934.) Continuation of 3747 of 1947.

534.1 : 621.392.51 **909**

Coordinates and the Reciprocity Theorem in Electromechanical Systems.—Miles. (*See* 969.)

534.1 : 621.392.51 **910**

Further Remarks on Reciprocity.—McMillan. (*See* 970.)

534.13 **911**

The Coupling of Two Acoustical Ducts.—A. E. Heins & H. Feshbach. (*J. Math. Phys.*, Oct. 1947, Vol. 26, No. 3, pp. 143–155.) A mathematical paper dealing with propagation along an infinite duct of rectangular cross-section. Two of the parallel walls are perfectly rigid, while at the intersection of a cross-sectional plane with the other two walls a discontinuous change of acoustical properties occurs. The reflection process at the discontinuity is examined.

534.2 **912**

Reflection and Transmission of Sound by Thin Curved Shells.—H. Primakoff & J. B. Keller. (*J. acoust. Soc. Amer.*, Sept. 1947, Vol. 19, No. 5, pp. 820–832.) A mathematical paper using Kirchhoff's theory to produce a non-homogeneous integral equation for the sound pressure field in an infinite medium containing a curved shell of different material. An approximate solution is obtained by evaluation of a surface integral very similar to that obtained in Kirchhoff's theory, and this gives expressions for the pressure waves reflected from and transmitted through a thin curved shell. The reflection coefficient is expressed as the product of a geometrical factor, a phase-cancellation factor, and a reflectivity factor. The Kirchhoff method is also applied to refraction at a curved surface, and the laws of reflection and refraction are obtained by combining the solutions for these problems.

534.231.3 + 621.3.011.2 : 621.395.623.7 **913**

A Continuously Variable Acoustic Impedance.—J. E. White. (*J. acoust. Soc. Amer.*, Sept. 1947, Vol. 19, No. 5, pp. 846–849.) Discussion of the relation between mechanical impedance and electrical load impedance of a loudspeaker, using three complex parameters. Measurements are given showing that the mechanical impedance can be varied over a fairly wide range. See also 3037 of 1943 (Fay).

534.321.9 : 534.845 : 551.596.1 **914**

High Frequency Absorption in Air and Other Gases.—L. J. Sivian. (*J. acoust. Soc. Amer.*, Sept. 1947, Vol. 19, No. 5, pp. 914–916.) The absorption coefficients for freely propagated plane waves are deduced qualitatively from preliminary measurements on the absorption of ultrasonic waves in gases inside cylindrical tubes. See also 1989 of 1947 (Schilling et al.).

534.321.9 : 620.179.1 **915**

Ultrasonic Resonance applied to Non-Destructive Testing.—Erwin & Rassweiler. (*See* 1112.)

534.321.9.001.8 **916**

Supersonics.—R. Lemas. (*Télévis. franç.*, Oct. 1947, No. 30, Supplement *Électronique*, pp. 37–40.) A brief review, with mention of some industrial applications.

534.422 **917**

A Powerful High Frequency Siren.—C. H. Allen & I. Rudnick. (*J. acoust. Soc. Amer.*, Sept. 1947, Vol. 19, No. 5, pp. 857–865.) Design, construction and performance of a high-intensity siren for frequencies of 3–34 kc/s. The measured efficiency was between 17% and 34% for 3–19 kc/s, with an acoustic output of 84–176 W. With modifications, acoustic outputs of 2 kW were obtained, the efficiency being about 20%. See also 922 below.

534.43 : 621.395.61 **918**

Crystal Pickups.—L. J. Wheeler & K. G. Lockyer. (*Wireless World,* Nov. 1947, Vol. 53, No. 11, pp. 412–414.) Design and construction details together with characteristic response curves and suggested input circuits for top correction and equalization.

534.612.4 **919**

Absolute Calibration of Microphones.—G. Buchmann. (*Funk u. Ton,* 1947, No. 1, pp. 30–32, 37–45.) A description and comparison of methods using (*a*) the Rayleigh disk in a Kundt's tube, (*b*) the pistonphone, (*c*) an auxiliary electrode, and (*d*) the reciprocity principle.

534.64 **920**

Measurement of Acoustic Impedances of Surfaces in Water.—R. D. Fay, R. L. Brown & O. V. Fortier. (*J. acoust. Soc. Amer.*, Sept. 1947, Vol. 19, No. 5, pp. 850–856.) An analytical and experimental investigation of water-filled impedance tubes, one a 6-ft length of heavy steel pipe 8 inches in diameter with a ½-inch wall, and another an 8-ft length of Al tube 5½ inches in diameter with a ¼-inch wall. The phase-velocity of sound in the tubes is nearly constant in the useful frequency range of 1 000–3 500 c/s, but less than the velocity of sound in free water. The variation of sound pressure along a tube radius depends upon the frequency.

534.64 : 534.833 **921**

A Short-Tube Method for Measurement of Impedance.—R. K. Cook. (*J. acoust. Soc. Amer.*, Sept. 1947, Vol. 19, No. 5, pp. 922–923.) The sound pressure within the tube, due to a sound source of known volume velocity, depends on the impedance of the walls of the tube. Impedances can be determined from absolute measurements of sound pressure in a short tube, for both isotropic and anisotropic materials. The short-tube method seems to have definite experimental advantages; temperature and frequency control are not expected to be as critical as in long-tube methods; gases other than air can be readily introduced, and gases such as hydrogen and helium can give important information about absorption due to gaseous viscosity effects in the pores of the acoustic material. See also 2117 of 1946 (Loye & Morgan).

534.7 : 534.422 **922**

Too Much Audio.—S. Y. White. (*Audio Engng,* May 1947, Vol. 31, No. 3, pp. 31..53.) An account of remarkable physiological effects produced by a turbo-generator with a maximum sound output of about 18 kW. As the rotor is speeded up, the ear ceases to respond at about 800 c/s. The eye goes out of focus when the power is about 3 kW. Between 5 and 8 kW there is a complete loss of muscular control and of memory. With several different rotor disks the frequency range extends to 24 kc/s. The total weight of the generator is only about 2½ lb. At low frequencies it acts as a simple siren taking up to 200 ft³/min at 60 lb pressure, but at the higher frequencies resonant chambers are used in the stator to build up a starting pressure about 3 times the static gas pressure.

534.75 **923**

The Effect of Frequency Spectrum on Temporal Integration of Energy in the Ear.—W. R. Garner. (*J. acoust. Soc. Amer.*, Sept. 1947, Vol. 19, No. 5, pp. 808–815.)

534.78 **924**

Methods of Measuring Speech Spectra.—S. S. Stevens, J. P. Egan & G. A. Miller. (*J. acoust. Soc. Amer.*, Sept. 1947, Vol. 19, No. 5, pp. 771–780.) Three methods were used to analyse speech, (*a*) square-law integrator (audio spectrometer), (*b*) linear integrator with valve voltmeter, and (*c*) R.C.A. noise meter and Esterline Angus graphic recorder. Each method gave substantially the same result. In each case a known acoustic spectrum was compared with an unknown spectrum. This method obviates the necessity for calibrating individual parts of each system separately. The standard spectrum (white noise) was obtained by passing current through a gas tube.

534.78 : 534.32 **925**

Phase Effects in Monaural Perception.—R. C. Mathes & R. L. Miller. (*J. acoust. Soc. Amer.*, Sept. 1947, Vol. 19, No. 5, pp. 780–797.) Discussion of experimental results which suggest that changing only the phase of one or more components of a complex wave train can alter appreciably the quality of the sound produced.

534.78 : 534.32 **926**

Studies on Pitch Discrimination in Masking: Part 2—The Effect of Signal/Noise Differential.—J. D. Harris. (*J. acoust. Soc. Amer.*, Sept. 1947, Vol. 19, No. 5, pp. 816–819.)

534.78 : 534.32 **927**

Masking Effect of Periodically Pulsed Tones as a Function of Time and Frequency.—R. L. Miller. (*J. acoust. Soc. Amer.*, Sept. 1947, Vol. 19, No. 5, pp. 798–807.)

534.833.4 **928**

Sound Absorption and Impedance of Acoustical Materials.—H. J. Sabine. (*J. Soc. Mot. Pict. Engrs,* Sept. 1947, Vol. 49, No. 3, pp. 262–278. Discussion, p. 278.) A review of recent theoretical and experimental investigations into the concept of acoustic impedance as applied to the prediction of the absorbing characteristics of a material, or of a particular construction, in terms of accurately defined and measurable physical properties. Curves are given showing how the physical properties of the materials are related to the sound absorption through the acoustic impedance, and that high absorption depends on the right combination of acoustic resistance and reactance. Application is made to the design of a number of commercial materials.

534.833.4 **929**

The Properties of Felt in the Reduction of Noise and Vibration.—F. G. Tyzzer & H. C. Hardy. (*J. acoust. Soc. Amer.*, Sept. 1947, Vol. 19, No. 5, pp. 872–878.)

534.844 : 534.861.1 **930**

Making Reverberation Time Tests in Broadcast Studios.—L. P. Reitz. (*Tele-Tech,* Oct. 1947, Vol. 6, No. 10, pp. 44–48, 92.) An illustration of the manner in which a reverberation analyser can be adapted to the modern acoustical problems of the architect and building-material manufacturer.

534.845 : 518.4 **931**

On the Design of Perforated Facings for Acoustic Materials.—R. H. Bolt. (*J. acoust. Soc. Amer.*, Sept. 1947, Vol. 19, No. 5, pp. 917–921.) A design chart such that when the acoustic impedance of an unfaced material is known, the absorption coefficient for that material with perforated facing can be read directly.

534.851 : 621.395.813 **932**

Dynamic Noise Suppressor.—H. H. Scott. (*Electronics*, Dec. 1947, Vol. 20, No. 12, pp. 96–101.) Broad principles were discussed in 991 of 1947. Here, a brief survey of noise-reduction systems is followed by complete technical details of a system to give almost noise-free reproduction of gramophone records. Circuits are given for a 2-valve gramophone version, and a 10-valve broadcast model. Signal-controlled reactance valves in filter circuits act as gates which control the shape of the audio response curve at low and high frequencies, and pass only the desired audio modulation. The fundamentals of desired high-frequency notes are filtered out and rectified by a control circuit which changes the bias, and hence the capacitance, of the high-frequency gate. Harmonics of low-frequency notes similarly vary the inductance of the low-frequency gate.

534.851 : 621.395.813 **933**

Audio Noise Reduction Circuits.—H. F. Olson. (*Electronics*, Dec. 1947, Vol. 20, No. 12, pp. 118–122.) Gramophone record noise is reduced by a single-channel system using Ge diodes as nonlinear elements. Amplitudes of noise level and below are eliminated without discriminating against the useful signal. Octave band-pass filters are used at input and output. Reproduction to 6 000 c/s is obtained with the low noise characteristics normally associated with 3 000-c/s cut-off. A 3-channel system for broadcast stations, effective to 12 000 c/s, is also described. Circuit diagrams and frequency response curves are shown.

534.86 : 534.322.1 **934**

High Audio Frequencies.—F. L. D. (*Wireless World*, Nov. 1947, Vol. 53, No. 11, pp. 415–416.) Comment on 3567 of 1945 (Chinn & Eisenberg). See also 1185 of 1947, 10 and 11 of January and back references.

534.861[/.862].1 **935**

Space Acoustics.—J. Y. Dunbar. (*J. Soc. Mot. Pict. Engrs*, Oct. 1947, Vol. 49, No. 4, pp. 372–382. Discussion, pp. 383–388.) The effects of area, shape and fittings of a studio on sound quality are discussed. Methods of acoustical treatment of enclosed areas are described and illustrated.

534.861.1 **936**

Audio Systems for F.M. Broadcasting.—J. D. Colvin. (*Audio Engng*, May 1947, Vol. 31, No. 3, pp. 11–14..51.) A discussion of circuit requirements and lay-out.

621.395.623.7 **937**

High Fidelity Loudspeaker of Unique Design.—J. K. Hilliard. (*Audio Engng*, May 1947, Vol. 31, No. 3, pp. 33–34.) Details of a loudspeaker with both a high-frequency diaphragm and a low-frequency cone driven, through a mechanical network, by a single large voice coil.

621.395.623.7 **938**

Loudspeaker Damping.—A. E. Cawkell : J. S. Smith : P. G. A. H. Voigt. (*Wireless World*, Nov. & Dec. 1947, Vol. 53, Nos. 11 & 12, pp. 447 & 487–488.) For other contributions to the correspondence see 13 of January.

621.395.623.7 **939**

Loudspeaker Design by Electro-Mechanical Analogy.—A. J. Sanial. (*Tele-Tech*, Oct. 1947, Vol. 6, No. 10, pp. 38–43..104.) A detailed analysis of the analogous behaviour of electrical circuits and mechanical systems. In the design of a loudspeaker the method followed involves a process of tentative computations which are successively corrected as the design proceeds. In this way the best possible values for the various interrelated circuit parameters can be obtained. The method is illustrated by the design of a typical horn loudspeaker, suitable primarily for voice reproduction.

621.395.623.8 **940**

Multiple Speaker Matching.—J. Winslow. (*Audio Engng*, May 1947, Vol. 31, No. 3, pp. 30, 52.) Methods of feeding a number of loudspeakers, either in series or in parallel, from a single amplifier, with proper matching to the output transformer. See also 14 of January (Chrétien) and back references.

621.395.625 **941**

The "Filmgraph" Sound Recording System.—J. H. Jupe. (*Electronic Engng*, Dec. 1947, Vol. 19, No. 238, p. 389.) A commercial recorder having a flat frequency response from about 75 to 5 000 c/s. The track is laterally indented on film, and in reproduction the same sound head and stylus are used. The recordings are in the 'permanent' class and 100 tracks can be recorded side by side on the same film.

621.395.625.2 **942**

Embossed High-Fidelity Recording.—R. Wagner. (*Audio Engng*, May 1947, Vol. 31, No. 3, pp. 24–26, 49.) Describes the principal features of a compact and simple recorder, suitable for home use. The 3¾-inch vinylite disk is 0.01 inch thick and has 515 lines per inch. The under side of the disk is pre-grooved, so that the disk acts as its own lead screw, guide-point and cutting stylus moving together across the disk as it is rotated.

621.395.625.3 **943**

Developments in Magnetic Recording.—P. T. Hobson. (*Electronic Engng*, Dec. 1947, Vol. 19, No. 238, pp. 377–382.) Based on a lecture to the British Sound Recording Association.

621.395.625.3 : 016 **944**

A Bibliography of Magnetic Recording.—D. W. Aldous. (*Electronic Engng*, Dec. 1947, Vol. 19, No. 238, pp. 390–391.) See also 642 of March (Haynes).

621.395.625.3 : 621.396.97 **945**

Magnetic Tape Recorders in Broadcasting.—H. A. Chinn. (*Audio Engng*, May 1947, Vol. 31, No. 3, pp. 7–10.) The relative merits of wire- and tape-recorders are discussed and the advantages of a paper- or plastic-base tape are stressed. One type of plastic tape developed in Germany had the magnetic material distributed uniformly throughout the thickness, but suffered from leakage between layers when coiled. A description is given of the Brush BK-401 Soundmirror, which is already in production. This uses a coated paper tape and is a complete recorder and reproducer with push-button control for recording, quick rewinding, and playback. Reprinted in *Electronic Engng*, Dec. 1947, Vol. 19, No. 238, pp. 393–395.

621.395.625.6 : 621.383.4 **946**

Lead-Sulfide Photoconductive Cells for Sound Reproduction.—Cashman. (*See* 1200.)

621.395.813 : 621.317.755 **947**

Simplified Intermodulation Measurement.—C. G. McProud. (*Audio Engng*, May 1947, Vol. 31, No. 3, pp. 21–23.) A standard test signal is applied to the input of an amplifier and the output is terminated with its normal impedance, across which are connected a high-pass filter and a c.r.o. Analysis of the resulting traces affords a clue to the source of distortion, if any is present, and gives an approximate indication of its amount.

AERIALS AND TRANSMISSION LINES

621.315.687 **948**

Tapered Coaxial Junctions.—S. Hershfield. (*Electronics*, Dec. 1947, Vol. 20, No. 12, p. 146.) Design considerations for a reasonably short taper and an adequate match in applications requiring negligible reflections.

621.392.029.64 : 621.3.017.21 **949**

Calculation of Losses due to the Joule Effect in Waveguides.—J. Oswald. (*Câbles & Transmission, Paris*, Oct. 1947, Vol. 1, No. 3, pp. 205–219. With English summary.) Of the two usual methods for such calculations, one is not very rigorous and does not reveal either the field perturbations or the variations of the phase velocity; the other is rigorous, but leads to difficult calculations. A method of calculation of the perturbations has the advantages of both methods. It applies to waveguides of arbitrary section and even to coaxial cables or Lecher lines. It is based on a fundamental formula, which is actually Green's formula applied to the Borgnis-Bromwich functions relative to perfectly and imperfectly conducting waveguides. A general expression is given for the boundary conditions. Development of the calculations reveals the perturbation of H waves; the structure of E waves is not appreciably modified. The formulae involve simple and double integrals uniquely related to the functions of Borgnis for perfectly conducting guides. These integrals have a very simple physical significance; their evaluation is extremely easy in the usual cases of guides of circular or rectangular cross-section. A table is given of formulae for the numerical calculation of the attenuation in different types of waveguides.

621.392.029.64 : 621.396.662.3 **950**

Quarter Wave Coupled Wave-Guide Filters.—Pritchard. (*See* 1000.)

621.396.67 **951**

Standard Reference Antennas.—C. E. Smith. (*Communications*, Nov. 1947, Vol. 27, No. 11, pp. 20, 38.) Characteristics of the omnidirectional uniform spherical radiator, used as the standard theoretical reference, and of the uniform hemispherical radiator, used as a standard of directivity and for computation of gain and efficiency.

621.396.67 **952**

Polyrod Antennas.—G. E. Mueller & W. A. Tyrrell. (*Bell Syst. tech. J.*, Oct. 1947, Vol. 26, No. 4, pp. 837–851.) A microwave endfire aerial consisting of a properly shaped dielectric rod protruding from a metal waveguide is described. Directional patterns are deduced from the theory of dielectric wire transmission, and the effects of phase lag on gain and of tapering on the aerial pattern are obtained. Experimental data on patterns for various lengths and shapes of rod, on crosstalk between rods and on methods of feeding are discussed.

621.396.67 **953**

Transmitting Antenna Inductive Coupling Methods.—S. Wald. (*Communications*, Nov. 1947, Vol. 27, No. 11, pp. 14–17.) An undesirable feature of the swinging-link type of aerial coupling is that the self-inductance of the coupling coil makes the aerial circuit reactive and so reduces the power transferred from the tank coil to the aerial. The theory of this type of coupling is discussed together with methods for neutralizing the reactance due to the link coil, and a rational design procedure is developed whereby the circuit parameters can be closely estimated at the first approximation.

621.396.67 : 517.512.2 **954**

Fourier Transforms in Aerial Theory : Part 4 — Fourier Approximation Curves.—Ramsay. (*See* 1068.)

621.396.67 : 621.396.97 **955**

The Theory of Antenna Design for F.M. Broadcasting.—G. Glinski. (*Tele-Tech*, Oct. 1947, Vol. 6, No. 10, pp. 31–37.) "A systematic review of the main features and characteristics of the principal types, with a mathematical analysis of their properties."

621.396.67 : 621.397.5 **956**

Television Aerials.—N. M. Best. (*Wireless World*, Nov. 1947, Vol. 53, No. 11, p. 448.) Author's reply to comment on 3799 of 1947 by Strafford & Pateman (29 of January).

621.396.67.029.64 **957**

Omnidirectional Centimetre-Wave Aerial using a Slotted Waveguide and E_{01} Waves.—J. Benoit. (*C. R. Acad. Sci., Paris*, 22nd Dec. 1947, Vol. 225, No. 25, pp. 1296–1297.) A cylindrical waveguide is used, of internal diameter 10 cm, mounted vertically. The radiating elements are resonant slots of length nearly equal to $\lambda_0/2$, where λ_0 is the wavelength in air; they cut the lines of longitudinal current at an angle θ, which in practice does not exceed 20°. A series of n slots is arranged with centres on the same generating line and $\lambda_g/2$ apart, where λ_g is the wavelength in the guide, the inclinations being alternately positive and negative. With 8 such series of slots arranged round the waveguide, a radiation pattern is obtained which is sensibly circular, the main beam being polarized horizontally.

621.396.677 **958**

An Approach to the Problem of Optimum Directive Antennae Design.—A. I. Uzkov. (*C. R. Acad. Sci. U.R.S.S.*, 10th July 1946, Vol. 53, No. 1, pp. 35–38. In English.) Given an aerial system arbitrarily situated in space, the directivity achieved in practice will vary with the method of excitation, but cannot exceed an optimum value associated with a unique method of excitation which can be determined analytically.

CIRCUITS AND CIRCUIT ELEMENTS

621.3.012.8 **959**

Equivalent Schemes for Electric Circuits with Periodic Parameters.—I. S. Bruk. (*C. R. Acad. Sci. U.R.S.S.*, 30th July 1946, Vol. 53, No. 3, pp. 221–224. In English.) Only a steady state under a sinusoidal change of applied voltage is considered. The recurrence formula relating the complex amplitudes of the different harmonics determines an infinite symmetric matrix which corresponds to a network with n node pairs when $n \rightarrow \infty$. Equivalent schemes of this kind permit qualitative conclusions without calculations. Two examples are given.

621.314.3† **960**

Magnetic Amplifier Circuits: Neutral Type.—A. S. Fitzgerald. (*J. Franklin Inst.*, Oct. 1947, Vol. 244, No. 4, pp. 249–265.) An outline of basic principles. The properties of saturating reactors and practical designs for amplifiers are considered. Methods are discussed for compensation of the rectified current produced in the later stages of a multi-stage amplifier by the normal magnetizing current of an earlier stage.

621.316.313.025 **961**

An A.C. Network Analyser.—(*Engineer, Lond.*, 7th Nov. 1947, Vol. 184, No. 4789, pp. 442–444.) A system of variable resistors, reactors, capacitors and transformers together with voltage sources variable in phase and magnitude which can be arranged to form a scaled-down counterpart of the system to be studied. The characteristics of the full-scale system may be evaluated and the effect of system changes predicted. It may also be used to solve mechanical problems that can be expressed in terms of electrical equivalents. Telephone-type apparatus is used for intercommunication and switching. When a problem is set up, all the system characteristics are computed as percentages of a selected voltage and kVA base. An example of the method of operation is given. For another account see *Overseas Engr*, Dec. 1947, Vol. 21, No. 242, pp. 156–157.

621.316.718 : 621.396.96 : 371.3 **962**

The Velodyne.—F. C. Williams & A. M. Uttley. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 7, pp. 1256–1274.) In order to synthesize the motion of aircraft in radar 'trainer' circuits, several time-integrators accepting voltage inputs are needed. The Velodyne was developed to meet special requirements in this connection, and is an electromechanical system in which a speed of rotation is held closely proportional to an input voltage by feedback methods. The total number of revolutions of the output shaft is a measure of the time-integral of the input voltage. The paper describes the evolution of the velocity-control system into an integrator, and also into a means of producing mechanical motion accurately related to input voltage according to more complex laws.

621.318.4 : 518.4 **963**

The Design of Small Single-Layer Coils.—A.I.F. Simpson. (*Electronic Engng*, Nov. 1947, Vol. 19, No. 237, pp. 353–360.) "Design charts relating the inductance, number of turns, and wire diameter for optimum Q for single-layer solenoid coils on formers of varying diameter."

621.319.4 **964**

Making Power Capacitors.—(*Elect. Rev., Lond.*, 2nd Jan. 1948, Vol. 142, No. 3658, pp. 3–7.) An illustrated account of the production methods employed at the works of British Insulated Callender's Cables, Ltd., for the manufacture of (*a*) oil-impregnated and oil-immersed paper-dielectric capacitors, (*b*) petroleum-jelly-impregnated paper-dielectric capacitors, and (*c*) electrolytic capacitors.

621.319.4 : 621.315.614.6 **965**

Paper Capacitors containing Chlorinated Impregnants: Part 4 — Benefits of Controlled Oxidation of the Paper.—D. A. McLean. (*Industr. Engng Chem.*, Nov. 1947, Vol. 39, No. 11, pp. 1457–1461.) Description of experiments on kraft capacitor paper showing that improved insulation resistance, power factor and d.c. life result from oxidation by means of controlled baking. Tables and graphs show that the improvements are more pronounced if the paper is subsequently impregnated with chlorinated diphenyl, and also that they persist after exposure to high humidity followed by redrying. For previous parts see 654 and 655 of 1947.

621.392 : 518.61 **966**

A Computational Method applicable to Microwave Networks.—Dicke. (*See* 1073.)

621.392.5 **967**

On the Theory of Quadripoles in Closed Chains.—P. Satche. (*Rev. gén. Élect.*, Oct. 1947, Vol. 56, No. 10, pp. 426–432.) A general study of 4-terminal networks, of which the quadripole is a particular case. By the introduction of new variables which play the same simplifying part as symmetrical coordinates in the case of polyphase networks, the equations of the 4-terminal network are put into a simple and suitable form. Equivalent networks and the homogeneous line are studied; this work will be extended in a later paper to 3-phase power-line networks and to a more exact examination of the homopolar network.

621.392.5 (083.5) **968**

Tables of Phase associated with a Semi-Infinite Unit Slope of Attenuation.—D. E. Thomas. (*Bell Syst. tech. J.*, Oct. 1947, Vol. 26, No. 4, pp. 870–899.) See also 2169 of 1946 (Bode).

621.392.51 : 534.1 **969**

Coordinates and the Reciprocity Theorem in Electromechanical Systems.—J. W. Miles. (*J. acoust. Soc. Amer.*, Sept. 1947, Vol. 19, No. 5, pp. 910–913.) "The (force-voltage, velocity-current) mechanical-electrical analogy yields circuit equations for an electrostatic electromechanical transducer which satisfy the reciprocity theorem, while the (force-current, velocity-voltage) analogy acts similarly for a magnetic transducer." Reversing the two analogies between the two types of transducer yields equations violating the reciprocity theorem in sign but not in magnitude. This indicates proper choice of coordinates in the application of Lagrange's equations to such systems. See also 370 of 1947 (McMillan) and 970 below.

621.392.51 : 534.1 **970**

Further Remarks on Reciprocity.—E. M. McMillan. (*J. acoust. Soc. Amer.*, Sept. 1947, Vol. 19, No. 5, p. 922.) Reply to criticism of 370 of 1947. See also 969 above.

621.392.52 + 621.396.611.3 **971**

Note on the Parallel-T Network.—M. P. Givens. (*Rev. sci. Instrum.*, Oct. 1947, Vol. 18, No. 10, p. 802.) By using capacitors with high leakage resistance, such as mica capacitors, the rejection ratio can be raised from 8 or 10 to 100 or even 1 000. See also 1464 of 1946 (Hastings) and 47 of January (McGaughan).

621.392.6 : 518.4 **972**

Graphical Calculation for Free and Forced Conditions.—P. Mourmant. (*Onde élect.*, Oct. 1947, Vol. 27, No. 247, pp. 371–384.) The physical behaviour of a passive multipole is briefly considered and the graphical representation of natural waves and of generalized impedance are discussed. The paper is mainly concerned with the application of graphical methods to series-parallel circuits to determine their response under various conditions and to investigate impedance and energy relations. The methods are used to analyse the impedance diagram of a Π network.

621.396.611.21 : 621.396.96 **973**

A Pulsed Crystal Oscillator Circuit for Radar Ranging.—D. J. Mynall. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 7, pp. 1207–1214.) A high precision circuit " which uses the now well-established method of controlling the range timing marker by means of a linear, continuous phase-shifting circuit. Its special features are the use of a pulsed quartz-crystal oscillator as the timing standard and the elimination of the separate, medium-precision timing circuit usually employed to select one range marker from the array potentially offered by the phase-shifting circuit. "Appendices deal with some of the factors involved in the design of the circuit."

621.396.611.33 : 518.3 **974**

Efficiency of Inductive Coupling.—A. C. Hudson. (*Electronics*, Dec. 1947, Vol. 20, No. 12, p. 138.) " Power transfer through inductively coupled resistive circuits is given directly from chart, or coil parameters can be found if required efficiency is known."

621.396.611.4 **975**

Electromagnetic Cavity Resonators.—G. de Vries. (*Philips tech. Rev.*, 1947, Vol. 9, No. 3, pp. 73–84.) " The forms of oscillation of certain electromagnetic flat cavity resonators are discussed (*i.e.*, resonators which may be considered as two-dimensional); namely the forms of oscillation of square plane cavity resonators and the non-rotation-symmetrical forms of oscillation of round plane cavity resonators. Further, the forms of oscillation of three-dimensional cavity resonators are dealt with. The case is then discussed of two coupled cavity resonators, the significance of which in high-frequency technology is analogous to that of coupled oscillation circuits in the region of lower frequencies, namely to that of a band filter."

621.396.615 **976**

Valve Oscillator.—J. R. Tillman. (*Wireless Engr*, Dec. 1947, Vol. 24, No. 291, pp. 357–371.) Analysis of a tuned circuit in which oscillations are maintained by a 2-valve amplifier with negative feedback. Amplitude limitation occurs when the input to the grid of the second valve exceeds the cut-off value, so that a distorted anode-current waveform is produced. In the analysis, the output of the maintaining circuit is removed and terminated in an impedance similar to that of the frequency discriminating circuit, to which a waveform is applied having its fundamental frequency component in phase with the amplifier output. The calculated frequency of oscillation agrees with that found by Groszkowski (1933 Abstracts, p. 564), but the present method enables results to be predicted from more easily available data. The frequency stability of this oscillator is shown to be comparable with that of a bridge-stabilized oscillator when the Q of the tuned circuit is greater than 100. See also 2188 of 1945 (Lynch & Tillman).

621.396.615 **977**

Blocking Oscillators.—R. Benjamin. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 7, pp. 1159–1175.) A general survey of their uses and of design considerations. Examples are given of their use in the generation of pulses at pre-selected repetition frequencies, both synchronized and free-running. Aperiodic triggered pulse-generators are also described and it is shown that delay-lines can be used for the accurate control of pulse length or repetition frequency. The network equations of the equivalent circuit of a blocking oscillator are derived and approximate equations for the pulse shape are obtained for particular cases.

621.396.615 **978**

Generator of Sub-Standard Metre Waves.—L. Liot. (*Radio franç.*, Oct. 1947, pp. 4–9.) Circuit and constructional details of a laboratory instrument with an output of about 10 W on a wavelength of 1.2 m. Frequency stability of the twin-triode master oscillator is achieved by means of a Kolster grid circuit, with $\lambda/4$ parallel lines for the anode circuit. The twin-triode amplifier uses $\lambda/2$ lines for its grid circuit, with coupling to the master oscillator anode circuit. $\lambda/4$ lines are used for the anode circuit, from which the output is taken through two 5 000-pF silvered mica capacitors.

621.396.615 **979**

RC Generator, 50 c/s-1 Mc/s.—F. Juster. (*Toute la Radio*, Nov. 1947, Vol. 14, No. 120, pp. 314–318.) Circuit and construction details.

621.396.615 **980**

Theory of Amplitude-Stabilized Oscillators.—P. Aigrain & E. M. Williams. (*Onde élect.*, Oct. 1947, Vol. 27, No. 247, pp. 385–391.) Three types are considered: (*a*) those in which the output is rectified, furnishing a d.c. voltage which is used to control the slope of the oscillating valve; (*b*) those in which the a.c. voltage is applied to a temperature-sensitive resistor, whose variations control the reaction; (*c*) those in which a derived d.c. voltage is used to vary the resistance of a control element. Oscillators of type (*b*) are found to be much more stable than those of type (*a*), while those of type (*c*) may have even greater stability, particularly if Pt is used for the control element. Optimum values for the circuit parameters are determined for each type.

621.396.615 **981**

EF50 as Crystal Oscillator.—J. Hum. (*Short Wave Mag.*, April 1947, Vol. 5, No. 2, pp. 84–86.) With suitable circuits an EF50 functioned well in a crystal oscillator with either triode or pentode connection. In the latter case the output to a dummy aerial was roughly the same as for a 6V6G valve whose anode current was more than double that of the EF50.

621.396.615.14 **982**
3-cm Continuous Range Oscillator.—I. M. Gottlieb. (*Electronics*, Dec. 1947, Vol. 20, No. 12, pp. 146..188.) Constant power is delivered at any frequency within the range 8 800–9 500 Mc/s. Frequencies are given on a dial, whose readings are checked by using a precision-calibrated tunable cavity as a wavemeter. Operation and design details are given.

621.396.615.14 **983**
A Simple 8-cm Wavelength Microwave Triode Oscillator.—C. L. Andrews. (*Gen. elect. Rev.*, Nov. 1947, Vol. 50, No. 11, pp. 40–43.) Constructional details of an experimental, low-power, single coaxial cavity oscillator which uses a disk-seal grounded-grid triode, Type 2C39. Prolonged periods of c.w. operation are not recommended but the oscillator may be used continuously when the output is modulated. A simple improvised intensity meter is described. See also 1483 of 1946 (Gurewitsch) and 209 of 1947 (White).

621.396.615.17 **984**
A Multiple-Pulse Generator for Synchronized Transmitter Systems.—D. M. Mackay. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 7, pp. 1199–1206.) The increasing number of radar sets used in a large warship makes it desirable so to synchronize the outgoing pulses that they can be presented simultaneously on the various displays. The development of a master trigger unit for this purpose is described and typical circuit diagrams are given.

621.396.615.17 : 621.317.755 **985**
Ranging Circuits, Linear Time-Base Generators and Associated Circuits.—F. C. Williams & N. F. Moody. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 7, pp. 1188–1198.) The target range in radar is obtained by measuring the delay time between the transmission of a r.f. pulse and the reception of the corresponding target echo. A linear timebase is required to measure this delay time accurately and the problems of generating a linear timebase or linearly-delayed strobes are discussed in detail. Circuit diagrams are given.

621.396.615.17 : 621.392.5 **986**
The Pulse-Testing of Wide-Band Networks.—Espley, Cherry & Levy. (*See* 1101.)

621.396.615.17 : 621.396.96 **987**
Automatic Strobes and Recurrence-Frequency Selectors.—F. C. Williams, F. J. U. Ritson & T. Kilburn. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 7, pp. 1275–1300.) These are both systems devised for radar purposes in which a locally-generated repetitive pulse (a 'strobe') is held in coincidence with an incoming repetitive pulse. In the automatic strobe, the incoming pulse is an echo of the transmitted pulse. In the recurrence-frequency selector, incoming pulses are not, in general, echoes, but are pulses received from a remote transmitter with a fixed repetition frequency. In both cases a 'time discriminator' is used to detect the error in the timing of local pulses relative to incoming pulses. Practical circuits and design details are given, and predicted performance is compared with experimental results.

621.396.622 : 621.396.619.13 **988**
Description and Operation of a New F.M. Detector Circuit.—D. Mansion. (*Onde élect.*, Oct. 1947, Vol. 27, No. 247, pp. 392–396.) The circuit combines in a single valve an oscillator and a reactance valve whose function is to make the oscillator frequency identical with that of the signal. The variation of anode current of the reactance valve is proportional to the frequency deviation of the signal. The operation of each part of the circuit is discussed in detail, and a diagram is given of the actual circuit used in the Philco model 1213, with component values. See also 227 of 1947 (Bradley).

621.396.645 **989**
High-Powered R.F. Linear Amplifiers.—C. W. Corbett. (*Communications*, Nov. 1947, Vol. 27, No. 11, pp. 22–25..36.) A discussion of circuits designed to provide high r.f. power in a.m. transmitters, with low distortion, low residual noise and high fidelity. Prominence is given to the method of linear amplification developed by Doherty (4020 of 1936), which is an effective combination of class-B and class-C operation and makes possible both high efficiency and linearity.

621.396.645 **990**
Anode Follower for Audio Gain.—R. Knowles. (*Short Wave Mag.*, April 1947, Vol. 5, No. 2, pp. 80–88.) The anode follower is capable of giving high gain and a distortionless output. Practical circuits are discussed.

621.396.645 : 539.16.08 **991**
A General Purpose Linear Amplifier.—W. H. Jordan & P. R. Bell. (*Rev. sci. Instrum.*, Oct. 1947, Vol. 18, No. 10, pp. 703–705.) For use in nuclear-particle counting experiments.

621.396.645 : 621.396.97 **992**
Remote Amplifier and Program Meter.—D. V. R. Drenner. (*Electronics*, Dec. 1947, Vol. 20, No. 12, pp. 140, 142.) A B.B.C. circuit ; full details are given. Two amplifier stages, using high-slope pentodes, give an overall gain of 90 db in the region 30–10 000 c/s. A dual potentiometer regulates both the input voltage to the second stage, and the feedback to the first stage. A special input transformer acts as a low-pass filter with cut-off at 10 000 c/s, as also does the output circuit of the second stage. Suitable choice of coupling capacitors gives a rising characteristic at about 2 000 c/s.

The peak programme meter consists of a diode and pentode, the latter having a right-hand-zero meter in the anode circuit. Programme voltages are rectified by a diode, which charges the capacitor connected across the grid circuit of the pentode, thereby affecting the anode current.

621.396.645.2 **993**
An Improved Method for coupling Valves at Ultra-Short Waves.—A. van Weel. (*Philips Res. Rep.*, April 1947, Vol. 2, No. 2, pp. 126–135.) A method of coupling two valves, or one valve with an aerial, which eliminates the difficulties due to the finite inductance of the valve internal leads and also simplifies the matching of the valve impedances to

the external circuits. The lead inductances and input and output capacitances form a low-pass Π filter, in which coarse tuning is accomplished by a series inductor or capacitor and fine tuning by a trimmer normally placed across the grid circuit. Examples are given of the application to tuned line circuits.

621.396.645.2 **994**

Cathode-Coupling.—E. Aisberg. (*Toute la Radio*, Oct. 1947, Vol. 14, No. 119, pp. 264–269.) A discussion of the basic principles and the advantages of the cathodyne or cathode-follower circuit, with applications for which it is particularly suitable on account of its high input impedance, low output impedance, negligible frequency distortion and harmonics, and phase equality between output and input.

621.396.645.2 : 518.4 **995**

Graphical Characteristics of Cathode-Coupled Triode Amplifiers.—C. J. LeBel. (*Audio Engng*, May 1947, Vol. 31, No. 3, pp. 40–41.) The characteristics of cathode-coupled amplifiers may be rapidly determined from equivalent triode analysis, using two simple charts to replace the usual laborious computations. See also 3066 of 1947 (Rifkin).

621.396.645.3 **996**

Optimum Load Impedance in Power Stages.—L. Chrétien. (*T.S.F. pour Tous*, Oct. 1947, Vol. 23, No. 228, pp. 208–212.) The optimum value for a class-A triode is not critical. It is better to select a value slightly higher than that corresponding to maximum power output, since this results in considerably reduced distortion with little loss of power. For pentodes the value is much more critical. It is preferable to select too low an impedance rather than too high. For symmetrical triode arrangements the use of too low an impedance causes odd harmonics to appear.

621.396.645.36 **997**

Push-Pull Balance.—W. T. Cocking. (*Wireless World*, Nov. 1947, Vol. 53, No. 11, pp. 408–411.) Discussion of the advantages of push-pull amplification, especially in output stages, with particular emphasis on the elimination of even-order harmonics and the removal of direct polarizing current in the output transformer. The problem of balance in a push-pull system is treated mathematically, and equations are given showing second and third harmonic distortion for a pair of valves either in parallel or push-pull. An example is given to show how the second-harmonic distortion of a pair of valves in push-pull varies with the various out-of-balance elements.

621.396.66 **998**

Tuning Circuits — Obvious and Otherwise.—"Cathode Ray". (*Wireless World*, Nov. 1947, Vol. 53, No. 11, pp. 442–445.) Discussion of the effect on v.h.f. tuned circuits of stray capacitance, and of the inductance and resistance of valves and wiring. Certain tuned circuits of apparently abnormal form are resolved into conventional types.

621.396.662.3 + 621.392.52 **999**

Calculation of Prototype Filters.—P. Grassot. (*C. R. Acad. Sci., Paris*, 3rd Nov. 1947, Vol. 225, No. 18, pp. 799–801.) It has been shown previously (660 of 1947) that the insertion loss of a symmetrical non-dissipative quadripole between a source and a load is a complex number $\vec{A}$ whose real and imaginary parts are given by formulae involving the reactances of the arms of the equivalent T and Π networks. From these formulae a diagram can be constructed representing the position of the point $\vec{A}$ when the frequency varies from 0 to ∞, thus giving geometrically the modulus $|A|$ and the argument $\hat{A}$ of $\vec{A}$, for all frequencies, without any simplifying hypothesis. This procedure is carried out for prototype filters of one or of two cells, terminated by two equal resistances matched to the filter. The constants of both **T** and Π filters are tabulated and diagrams are given showing $\vec{A}$ and $|A|$ as functions of a quantity n, which is related to certain reactances inversely proportional to one another. Formulae for the insertion loss in the two cases are also given.

621.396.662.3 : 621.392.029.64 **1000**

Quarter Wave Coupled Wave-Guide Filters.—W. L. Pritchard. (*J. appl. Phys.*, Oct. 1947, Vol. 18, No. 10, pp. 862–872.) Rectangular cavities each formed by a pair of spaced inductive irises inserted in the waveguide section are considered; the cavities are separated from each other by $\lambda/4$ sections and are tuned to the same frequency. Matrix analysis is used first to determine the resonant frequency, phase shift, loaded Q and loss in the pass band of a single cavity, and is then extended to the case of n units in cascade. The design procedure to achieve required filter characteristics is outlined, and includes an analysis of the susceptance of an inductive iris made of metal of finite thickness.

621.396.662.32 **1001**

Principles and Construction of Low-Pass Filters.—S. Coudrier. (*T.S.F. pour Tous*, Oct. 1947, Vol. 23, No. 228, pp. 226–228.) Simple calculations with practical examples.

621.396.69 + 621.385.1 **1002**

Miniaturization.—M. Adam. (*Toute la Radio*, Nov. 1947, Vol. 14, No. 120, pp. 303–307.) A review of the methods of production of miniature components and circuits, with a table of American miniature valves.

621.396.69 **1003**

Printed Vitreous Enamel Components.—C. I. Bradford, B. L. Weller & S. A. McNeight. (*Electronics*, Dec. 1947, Vol. 20, No. 12, pp. 106–108.) A sprayed-enamel printed-silver process for making printed circuits, h.v. connectors, and capacitors with electrical characteristics comparable to those of mica capacitors. See also 1913 of 1947 (Sargrove).

621.396.96 **1004**

Light-Weight Radar: Its Dependence on Low-Consumption Circuits.—H. R. Whitfield. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 7, pp. 1215–1218.) Radar circuits designed for economy in weight and power are described and the use of pulse ratings, tropic-proofed materials and miniature valves is discussed.

621.396.96 **1005**

Plan-Position Indicator Circuits.—F. C. Williams, W. D. Howell & B. H. Briggs. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 7, pp. 1219–1255.) The systems described were developed for use with airborne radar equipments in which the time delay of the echoes is proportional to the distance from the aircraft to the reflecting object (slant range). A correction is necessary in order to display the distance from the reflecting object to a point on the ground vertically below the aircraft (ground range). This correction to the delay time is a function of height and slant range, and the paper describes several 'height-correction' circuits. Circuits are also described which eliminate the motion of the display across the c.r. screen due to the velocity of the aircraft. The centre of the display is moved at a rate proportional to this velocity, and arrangements can be made to fix the North direction on the display tube for easy comparison with maps. Circuits are considered for both e.s. and e.m. deflection.

GENERAL PHYSICS

53.081 + 621.3.081.1 **1006**

On the 'Rationalization' of Units and of Electromagnetic Formulae.—C. Budeanu. (*Bull. Soc. franç. Élect.*, Oct. 1947, Vol. 7, No. 74, pp. 563–572.) Considerations are advanced which lead to the definite rejection of all schemes of so-called rationalization, in favour of units expressed simply in terms of the c.g.s. e.m. system, in accordance with the decisions of international congresses and of the Commission Électrotechnique Internationale. A comparison table, giving the dimensions of 25 quantities, includes the factor 4π in 11 'non-rationalized' expressions and in 14 'rationalized' expressions. Moreover, the suppression of the factor 4π in many 'rationalized' formulae is of no advantage in numerical calculations, so that rationalization would appear to be a complication without practical utility. See also 1392 and 2383 of 1947 (Dorgelo & Schouten) and 1007 below.

53.081 **1007**

The Giorgi System of Units in relation to Tradition, Practice and Instruction.—P. Grivet. (*Bull. Soc. franç. Élect.*, Nov. 1947, Vol. 7, No. 75, pp. 594–628.) A comprehensive discussion of the c.g.s., e.s. and e.m. systems of units and of the merits, defects and practical characteristics of the rationalized Giorgi system. Tables are given of numerous electrical formulae in (*a*) the non-rationalized, and (*b*) the rationalized system. See also 2383 of 1947 (Dorgelo & Schouten) and 1006 above.

53.081 **1008**

Magnetic Units: A Correction.—"Cathode Ray". (*Wireless World*, Nov. 1947, Vol. 53, No. 11, pp. 447–448.) Correction to 75 of January.

535.13 **1009**

New Representation and More General Form of the Classical Equations of Electromagnetism.—É. Durand. (*C. R. Acad. Sci., Paris*, 6th Oct. 1947, Vol. 225, No. 14, pp. 567–569.)

535.338.1 : 621.385.1.032.216 **1010**

Measurement of the Monochromatic Emission from Oxide Cathodes.—R. Champeix. (*C. R. Acad. Sci., Paris*, 27th Oct. 1947, Vol. 225, No. 17, pp. 728–729.) Very careful determinations of the temperatures of oxide cathodes from brightness measurements for two different heating powers, show that the spectral emissive power varies widely from one cathode to another. The experimental values ranged from 0.07 to 0.26. The cause of such wide variations will be investigated.

537.122 **1011**

The Electron.—J. A. Crowther. (*Electronic Engng*, Nov. 1947, Vol. 19, No. 237, pp. 343–347.) Long summary of a lecture given to celebrate the 'Electron Jubilee' (395 of February). The events leading to the acceptance of the corpuscular theory of cathode rays in preference to the wave theory are discussed.

537.122 : 621.3.032.2 **1012**

Energy Exchanges between Electrons and Electrodes at Constant Potential.—P. M. Prache. (*Câbles & Transmission, Paris*, Oct. 1947, Vol. 1, No. 3, pp. 221–225. With English summary.) Very general theory is developed concerning the motion of electrons between electrodes connected to external sources of potential. In certain simple cases it is possible to deduce the value of the current in the conductors connecting the electrodes to their sources. As an example, the motion of an infinitely thin layer of electrons between plane parallel electrodes is considered.

537.291 : 621.385.833 **1013**

On the Determination of the Principal Elements of Electron Mirrors.—É. Regenstreif. (*Ann. Radioélect.*, Oct. 1947, Vol. 2, No. 10, pp. 348–358.) A short discussion of the physics of e.s. lenses and mirrors. Detailed calculations are given for diverging and converging mirrors. Tables are also given for the electron trajectories for an e.s. lens.

537.312.62.029.63 **1014**

The Surface Impedance of Superconductors and Normal Metals at High Frequencies: Parts 1–3.—A. B. Pippard. (*Proc. roy. Soc. A*, 18th Nov. 1947, Vol. 191, No. 1026, pp. 370–415.) The h.f. resistance of superconducting Sn and Hg is finite at all temperatures, tending to a very low value (probably zero for Hg but not for Sn) at absolute zero. The skin conductivity of Ag, Au and Sn tends to become independent of d.c. conductivity; this is qualitatively explained by London's theory (867 of 1941) which predicts constancy of skin conductivity when the electron mean free path becomes much greater than the skin depth. Measurements of skin reactance enable the superconducting penetration depth to be deduced; for Hg it is found to be about 7×10^{-6} cm at 0°K, in agreement with Shoenberg's direct measurements (*Proc. roy. Soc. A*, 28th March 1940, Vol. 175, No. 960, pp. 49–70).

The dependence of penetration depth upon temperature is deduced from resistivity measurements, using the theory developed in the paper, and is in good agreement with reactance measurements. The theory is critically discussed and it is shown that Heisenberg's theory of superconductivity explains satisfactorily the relation between superconducting and normal electrons.

538.531 **1015**

The Self-Inductance of a Wire curved into a Circular Arc.—L. A. Zeitlin. (*C. R. Acad. Sci. U.R.S.S.*, 20th Aug. 1946, Vol. 53, No. 5, pp. 429–432. In English.) A general formula is derived, and possible simplifying approximations in various practical cases are considered.

538.566 **1016**

On the Integro-Differential Equation for the Propagation of Electromagnetic Waves in a Medium with Dielectric and Magnetic Viscosity.—M. I. Rosovsky. (*C. R. Acad. Sci. U.R.S.S.*, 10th Sept. 1946, Vol. 53, No. 7, pp. 601–604. In English.)

538.569.4.029.64 **1017**

A Double Modulation Detection Method for Microwave Spectra.—R. J. Watts & D. Williams. (*Phys. Rev.*, 1st Dec. 1947, Vol. 72, No. 11, pp. 1122–1123.)

538.569.4.029.64 : 546.171.1 **1018**

Saturation Effect in Microwave Spectrum of Ammonia.—T. A. Pond & W. F. Cannon. (*Phys. Rev.*, 1st Dec. 1947, Vol. 72, No. 11, pp. 1121–1122.) See also 406 of February (Smith & Carter) and back references.

538.569.4.029.64 : 546.171.1 **1019**

Anomalous Values of Certain of the Fine Structure Lines in the Ammonia Microwave Spectrum.—H. H. Nielsen & D. M. Dennison. (*Phys. Rev.*, 1st Dec. 1947, Vol. 72, No. 11, pp. 1101–1108.)

538.691 **1020**

Motion of Particles in Uniform and Non-Uniform Magnetic Fields.—F. Ehrenhaft. (*C. R. Acad. Sci., Paris*, 17th Nov. 1947, Vol. 225, No. 20, pp. 926–928.) In the very inhomogeneous field produced by an alnico magnet with a pointed south pole-piece, paramagnetic particles move, in general, towards the plane north pole, while diamagnetic particles move towards the point. An explanation of these anomalous results is suggested.

539.16.08 **1021**

Equation of the Curve $I = f(N)$ relating the Luminous Flux received by Photon Counters and the Number of Discharges registered.—S. Lormeau. (*C. R. Acad. Sci., Paris*, 10th Nov. 1947, Vol. 225, No. 19, pp. 865–867.) The curves, for counters with CuI or Mg cathodes and an atmosphere of alcohol or argon, are not straight lines; they are approximately parabolic and can be represented by equations of the type $I = aN + bN^2$, where b is small.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

521.15 : 538.12 **1022**

On the Magnetism of Celestial Bodies.—A. Dauvillier. (*C. R. Acad. Sci., Paris*, 10th Nov. 1947, Vol. 225, No. 19, pp. 839–841.) The author considers that stellar and planetary magnetism are not of the same nature and that the second is dependent on the first. Calculation of the ratio of the magnetic moment of the moon to its rotational moment, based on its probable magnetite content, gives a value about a thousand times greater than Blackett's value of approximately 10^{-15} c.g.s. units (3112 of 1947).

521.15 : 538.12 **1023**

On the Relation between the Magnetic Moment and the Moment of Rotation of Spherical Bodies.—A. Giao. (*C. R. Acad. Sci., Paris*, 17th Nov. 1947, Vol. 225, No. 20, pp. 924–926.) Amplification of previous theory, giving formulae for the magnetic moment which are valid for all values of the electric charge on the sphere, including zero. See 3892 of 1947 and back references.

523.3 + 523.7] : 550.384.4 **1024**

Location of the Currents causing the Solar and Lunar Diurnal Magnetic Variations.—D. F. Martyn: S. Chapman. (*Nature, Lond.*, 18th Oct. 1947, Vol. 160, No. 4068, pp. 535–537.) Difficulties are experienced in assigning both the solar and lunar diurnal variations of the geomagnetic field to 'dynamo' action in a single ionized region. Although there is evidence that the main part of the solar variation is produced in and near the D region, the other regions exhibit too great sunspot variation and too little seasonal variation in conductivity to explain the lunar variations. Statistical studies of ionospheric tides have suggested that ionospheric height movements may be interpreted in terms of the direction of the 'dynamo' currents and it has been found that the currents in the E and F regions are almost exactly out of phase with those required for the lunar variations which are probably produced in the D region.

Chapman, in a footnote, remarks that Martyn's suggestions imply horizontal inducing motions due to the sun, in the D, E and F layers, which are in phase with one another, and lunar tidal horizontal motions which in the D layer are opposite in phase to those in the E and F layers; on present knowledge this does not seem to be excluded.

523.5 : 621.396.82 **1025**

Electron Density in Meteor Trails.—A. C. B. Lovell. (*Nature, Lond.*, 15th Nov. 1947, Vol. 160, No. 4072, pp. 670–671.) At frequencies of 60–70 Mc/s, the radio echo is obtained only when the aerial beam is directed at right angles to the track of the meteor. This can be explained if the ionization is in the form of a long column of diameter small compared to λ. The intensity of the radiation scattered coherently from such a column was calculated by Blackett & Lovell (707 of 1941) and a formula connecting the electron density, the power scattered back and the constants of the radar set is here given. Experimental results for meteor showers of August and September 1947 are discussed and found to be in reasonable agreement with the formula.

523.72 : 621.396.822.029.62 **1026**

Solar Radio Emissions.—J. F. Denisse. (*C. R. Acad. Sci., Paris*, 22nd Dec. 1947, Vol. 225, No. 25, pp. 1358–1360.) A theoretical explanation is given of the solar conditions which favour radio emission and also cause a considerable increase of electron kinetic energy. Numerical calculations are consistent with observations. See also 1759 of 1947.

523.75 **1027**

On the Mechanism of the Discharge of Geoactive Corpuscles from the Surface of the Sun.—Z. R. Mustel. (*C. R. Acad. Sci. U.R.S.S.*, 21st April 1947, Vol. 56, No. 3, pp. 245–247. **In Russian.**)

550.38 : 525.624 **1028**

Induction Effects in Terrestrial Magnetism: Part 3 — Electric Modes.—W. M. Elsasser. (*Phys. Rev.*, 1st Nov. 1947, Vol. 72, No. 9, pp. 821–833.) The theory of inductive coupling developed in previous parts (1834 of 1946 and 98 of 1947) is applied to the interaction of the magnetic and electric modes. The couplings between the modes may be interpreted as a feedback amplifier whereby the field can be maintained by the power delivered to it by the fluid motion. The power for the maintenance of the field is provided from the rotational energy lost by the earth as it is slowed down by the action of the lunar tide.

551.508.99 : 621.396.96 **1029**

The Use of Airborne Navigational and Bombing Radars for Weather-Radar Operations and Verifications.—Miller. (*See* 1045.)

551.510.535 **1030**

On Certain Physical Phenomena in the Ionosphere and Their Interpretation (the Sporadic F_2-layer).—J. L. Alpert. (*C. R. Acad. Sci. U.R.S.S.*, 20th July 1946, Vol. 53, No. 2, pp. 107–110. In English.) The asymmetry of observed ' three-tailed ' height/frequency characteristics contradicts the theory that the extraordinary wave suffers reflection in the regions of both zeros of its refractive index. An explanation of the appearance of extra ' tails ' is given in terms of an additional ' sporadic F ' layer which may be mixed with the ordinary F layer and contains a system of sufficiently large ionized clouds separated by distances large compared to λ. For a sufficiently pronounced ' sporadic F ' layer the height/frequency curves will have 4 tails. See also 105 of January.

551.510.535 : 550.38 **1031**

F_2 Ionization and Geomagnetic Latitudes.—P. H. Liang : E. V. Appleton. (*Nature, Lond.*, 8th Nov. 1947, Vol. 160, No. 4071, pp. 642–643.) Liang plots the noon F_2 critical frequencies (f^0F_2) for March and September 1946, and the midnight f^0F_2 values for the latter month, as a function of (*a*) geomagnetic latitude and (*b*) dip angle ; (*a*) is preferred. The data are discussed and compared with those of Appleton (2898 of 1946) and Mitra (728 of 1947). The symmetry of the observations about the geomagnetic equator is pointed out, and its significance considered. Appleton agrees that (*a*) is preferable.

551.510.535 : 621.396.11 **1032**

On the Anisotropy Effect of the Ionosphere.—J. L. Alpert. (*C. R. Acad. Sci. U.R.S.S.*, 20th Sept. 1946, Vol. 53, No. 8, pp. 699–702. In English.) Ionospheric reflection was studied with the apparatus used for the work described in 2093 of 1947 (Al'pert & Gorozhankin). The frequency of the 0.5-kW transmitter was altered stepwise during half-hourly periods of observation. The direct and reflected pulses were received at a distance. Changes in the effective paths of reflection and in the angle of arrival of reflected waves occurred which appeared to be due to ' magnetoactive ' anisotropy ; a somewhat analogous effect can occur in crystals. The changes occur when the incident wave is split up into an ordinary and an extraordinary wave ; their character depends upon the angle between the path of ground-wave propagation and the magnetic meridian. A tentative theoretical explanation of the results is given.

551.511 **1033**

On the Distribution of Angular Velocity in Gaseous Envelopes under the Influence of Large-Scale Horizontal Mixing Processes.—C. G. Rossby. (*Bull. Amer. met. Soc.*, Feb. 1947, Vol. 28, No. 2, pp. 53–68.) The limiting zonal wind distribution in the atmosphere resulting from thermally-produced lateral mixing processes is calculated, the atmosphere being considered as a thin spherical shell. Some of the more striking features of the zonal wind distribution at the tropopause level are explained by assuming a mixing process associated with a tendency towards equalization of the vertical component of the absolute vorticity. The theory also accounts for the observed ' equatorial acceleration ' of the solar photosphere. The limitation imposed by shearing instability on the zone of constant absolute vertical vorticity is in agreement with the apparent break in the law for solar rotation at about 30° heliographic latitude.

551.594.2 : 629.132.13 **1034**

Discharge Currents associated with Kite Balloons.—R. Davis & W. G. Standring. (*Proc. roy. Soc. A*, 18th Nov. 1947, Vol. 191, No. 1026, pp. 304–322.) The currents flowing in the cables of barrage balloons are investigated as a function of balloon height and of vertical electric field near the foot of the cable. In thundery weather charges of the order of coulombs are transferred by currents ranging from milliamperes flowing for minutes to kiloamperes flowing for milliseconds. Indications of the charge distribution in clouds and the mechanism of lightning strokes (current $>$ 500 A) are obtained ; " the proportion of positive to negative discharges appears to be greater at the higher current values".

LOCATION AND AIDS TO NAVIGATION

534.88 : 551.464.018.4 **1035**

Anti-Sonar.—M. (*See* 1107.)

621.396.663 + 621.396.933 **1036**

New Radio Compasses.—(*Wireless World*, Nov. 1947, Vol. 53, No. 11, pp. 417–419.) Details of aircraft radio equipment exhibited recently at Radlett aerodrome. Comprehensive descriptions with photographs of two new radio compasses manufactured respectively by G.E.C. and Marconi's Wireless Telegraph Company. An intercommunication system, general purpose transmitters and receivers, and a compact v.h.f. R/T link are also mentioned. See also 423 of February.

621.396.9 : 629.13.014.57 **1037**

Automatic Controls for Pilotless Ocean Flight.—J. M. (*Electronics*, Dec. 1947, Vol. 20, No. 12, pp. 88–92.) Description of pilotless flight from Newfoundland to England, and of the various control units.

621.396.933 + 621.396.96 **1038**

Developments in Airline Radio and Radar Communications and Navigational Facilities.—H. J. Brown. (*Proc. Instn Radio Engrs, Aust.*, Oct. 1947, Vol. 8, No. 10, pp. 19–21.) Discussion on 426 of February.

621.396.933 + 621.396.96 **1039**

Position-Finding by Radio : First Thoughts on the Classification of Systems.—C. E. Strong. (*Engineer, Lond.*, 7th Nov. 1947, Vol. 184, No. 4789, pp. 446–447.) Long abstract of Chairman's address, Radio Section, I.E.E. The need for revising current terminology for classifying radio position finding systems is stressed. A time-sharing multiplex system combining radar and communication services to aircraft on a common frequency is described. For another account see *Electrician*, 24th Oct. 1947, Vol. 139, No. 3619, p. 1221.

621.396.933 : 621.396.96 **1040**

Radar System for Airport Traffic and Navigation Control : Parts 2 & 3.—F. J. Kitty. (*Tele-Tech*, Sept. & Oct. 1947, Vol. 6, Nos. 9 & 10, pp. 56–59 . . 107

& 49–51 . . 94.) Two radar sets operating in the 9 000-Mc/s band are used. One set scans vertically to determine accurately the angular elevation of the aircraft, and so detects any deviation from a preselected glide path. The second set is similarly used to ensure that the course of the aircraft is along the centre line of the runway. Part 1 : 114 of January.

621.396.933.1 **1041**

Hazeltine Lanac System of Navigation and Collision Prevention.—K. McIlwain. (*Proc. Radio Cl. Amer.*, Feb. 1947, Vol. 24, No. 2, pp. 3–28.) A very comprehensive and detailed account of the system and its operation. See also 2435 of 1947.

621.396.96 **1042**

Various Papers on Radar Circuit Techniques.—See Circuits section.

621.396.96 **1043**

Targets for Microwave Radar Navigation.—S. D. Robertson. (*Bell Syst. tech. J.*, Oct. 1947, Vol. 26, No. 4, pp. 852–869.) The effective echoing areas of certain radar targets can be calculated by the methods of geometrical optics. Other more complicated structures have been investigated experimentally. This paper considers a number of targets of practical interest with particular emphasis on trihedral and biconical corner reflectors. The possibility is indicated of using specially designed targets of high efficiency as aids to radar navigation.

621.396.96 (94) **1044**

Lightweight Air Warning and G.C.I. Radar in Australia.—J. N. Briton. (*J. Instn Engrs Aust.*, June 1947, Vol. 19, No. 6, pp. 121–132.) War-time requirements are discussed. Developments to overcome both operational difficulties of transport and climate, and production difficulties due to lack of components, are described in detail.

Metre-wave equipment used during the war is reviewed and new centimetre-wave equipment, developed at the end of the war to eliminate faults of earlier types, is briefly described.

621.396.96 : 551.508.99 **1045**

The Use of Airborne Navigational and Bombing Radars for Weather-Radar Operations and Verifications.—R. W. Miller. (*Bull. Amer. met. Soc.*, Jan. 1947, Vol. 28, No. 1, pp. 19–28.) A brief account of previous work is given, followed by a description of test flights made to investigate the conditions giving rise to weather echoes, and the best means of using radar operationally for weather purposes. Modified radar equipment was used in conjunction with recording meteorological instruments. The results, which are illustrated by radar photographs, show that although weather echoes do not necessarily mean areas of heavy turbulence, the use of airborne radar as a weather aid is definitely justified. There is a need for development of more suitable radar equipment for this purpose.

621.396.96 : 621.396.621 **1046**

The Radar Receiver.—Morrison. (*See* 1142.)

621.396.93 **1047**

Wireless Direction Finding. [Book Review]—R. Keen. Iliffe & Sons, London, 4th edn, 1059 pp., 45s. (*Elect. Rev., Lond.*, 2nd Jan. 1948, Vol. 142, No. 3658, p. 18.) "The book with its valuable bibliography, now containing over 400 references, can be strongly recommended to all students, engineers and operators who are concerned with the practice of this subject." Radar technique is excluded, but a new chapter describes some modern navigation systems, including gee, loran, decca and consol, and the chapter on beacon systems is considerably enlarged. See also *Wireless Engr*, Dec. 1947, Vol. 24, No. 291, p. 372.

621.396.933 **1048**

Radio Aids to Navigation. [Book Review]—R. A. Smith. Cambridge University Press, London, 114 pp., 9s. (*Wireless Engr*, Dec. 1947, Vol. 24, No. 291, p. 373.) The material was originally prepared for the Ministry of Supply (Air) Scientific War Records. "The various systems are briefly described in general terms, sometimes with the aid of block diagrams, and their main characteristics are given." For another review see *Wireless World*, Jan. 1948, Vol. 54, No. 1, p. 30.

MATERIALS AND SUBSIDIARY TECHNIQUES

535.37 **1049**

Certain Peculiarities in the Luminescence of the Zinc-Cadmium Phosphors.—V. A. Yastrebov. (*C. R. Acad. Sci. U.R.S.S.*, 10th Sept. 1946, Vol. 53, No. 7, pp. 605–606. In English.) The effect of heating on the luminescence of ZnS-CdS-Cu phosphors with varying CdS content was investigated. A mercury lamp was used for excitation. It appears that structural changes occur in these phosphors when they are heated through the temperature range 180°C–330°C; these changes persist for several hours after cooling. The brightness of the phosphor at a given temperature may be increased temporarily by as much as 40%.

535.37 : 621.385.832 **1050**

The Application of Chemically Unstable Phosphors to Cathode Ray Tubes.—Head. (*See* 1212.)

535.371 + 621.3.017.143] : 546.472.84 **1051**

Dielectric Losses and Fluorescence of Zinc Silicate.—G. Szigeti & E. Nagy. (*Nature, Lond.*, 8th Nov. 1947, Vol. 160, No. 4071, pp. 641–642.) The variations of the fluorescence (2 537 Å excitation) and conductivity (at 20 Mc/s, without ultraviolet irradiation) within the temperature range 285–665°K are described and discussed. It is deduced "that the ultimate absorption of the ultra-violet radiation takes place in centres, the number of which is in close relation to the electrical conductivity."

538.221 **1052**

Thermomechanical Treatment of Ferromagnetic Materials.—J. S. Shur & A. S. Khokhlov. (*C. R. Acad. Sci. U.R.S.S.*, 10th July 1946, Vol. 53, No. 1, pp. 39–40. In English.) The magnetic properties of a material can be improved by subjecting it to elastic tension or compression while it is cooled from a temperature above the Curie point to room temperature. For maximum effects, (*a*) tension must be used for positive and compression for negative magnetostriction materials, (*b*) the Curie point must be high enough to permit the release of magnetostriction stresses by annealing, (*c*) the magnitude of the load must have a certain optimum value, and (*d*) the energy of magnetostriction stresses produced by elastic stresses must be comparable to the energy of magnetic anisotropy.

538.221 **1053**

Interpretation of High Coercivity in Ferromagnetic Materials.—E. C. Stoner & E. P. Wohlfarth. (*Nature, Lond.*, 8th Nov. 1947, Vol. 160, No. 4071, pp. 650–651.) It is improbable that the relation of the coercivity to the amplitude of internal stress variations can account for coercivities in excess of 500 oersteds. An alternative theory is outlined, the central idea of which is that " there may occur ' particles ' . . . distinct in magnetic character from the general matrix, and less than the critical size, depending on shape, for which domain boundary formation is energetically possible." The mechanism proposed, involving magnetically anisotropic single-domain particles, is likely to be important in powder magnets, non-ferromagnetic metals and alloys containing ferromagnetic ' impurities ' and high coercivity alloys of the dispersion-hardening type. A fuller account will be published shortly ; for similar work by Néel see 3151 and 3152 of 1947.

538.221 **1054**

Mechanism of Ferromagnetic Dispersion.—J. B. Birks. (*Nature, Lond.*, 18th Oct. 1947, Vol. 160, No. 4068, p. 535.) See also 748 of 1947.

539.26 **1055**

Study of Surface Layers by means of X Rays.—C. Legrand. (*C. R. Acad. Sci., Paris*, 27th Oct. 1947, Vol. 225, No. 17, pp. 731–733.)

546.287 **1056**

The Production and Properties of Silicones.—D. W. Glover & R. L. Bull. (*P. O. elect. Engrs' J.*, Oct. 1947, Vol. 40, Part 3, pp. 120–123.) Fundamental methods of production are described and possible applications mentioned.

620.197 **1057**

Protective Finishing of Electrical Equipment.—F. Widnall & R. Newbound. (*J. Instn elect. Engrs*, Part II, Oct. 1947, Vol. 94, No. 41, pp. 512–522. Discussion, pp. 522–528.) Full paper : summary abstracted in 3543 of 1947.

621.315.59 **1058**

Semi-Conductors.—H. S. W. Massey. (*J. sci. Instrum.*, Aug. 1947, Vol. 25, No. 8, pp. 220–224.) Based on a lecture given at the Institute of Physics. Relation of the conducting properties of a crystal to the energy levels of the electrons within it leads to a useful working model of a semiconductor. The importance of impurities and of departures from the stoichiometric proportions is discussed. Rectifying and optical properties are also considered.

621.315.611.011.5 + 537.226.3 **1059**

A Remarkable Property of Technical Solid Dielectrics.—M. Gevers & F. K. du Pré. (*Philips tech. Rev.*, 1947, Vol. 9, No. 3, pp. 91–96.) The ratio of the temperature coefficient of the dielectric constant to the tangent of the loss angle is found to be approximately constant. This is explained by assuming the presence in the substance of (*a*) dipoles, (*b*) semiconducting regions, or (*c*) free ions. See also 3929 of 1947 and back references. In 3548 of 1947 the value of the above ratio was given incorrectly as 0.6 ; it should have been 0.06.

621.315.611.011.5 + 537.226.3 **1060**

The Relation between the Power Factor and the Temperature Coefficient of the Dielectric Constant of Amorphous Solid Dielectrics.—M. Gevers. (*Tijdschr. ned. Radiogenoot.*, Nov. 1947, Vol. 12, No. 6, pp. 185–200. In Dutch, with English summary.) See 3548, 3572 and 3929 of 1947.

621.315.612 : 621.315.62 : 620.197.6 **1061**

The Electrical Properties of Semi-Conducting Ceramic Glazes.—J. S. Forrest. (*J. sci. Instrum.*, Aug. 1947, Vol. 24, No. 8, pp. 211–217.) The use of semiconducting ceramic glazes in the design of porcelain insulators for humid conditions is discussed. The glazes comprise relatively large proportions of metal oxides embedded in a glassy matrix. The properties of a glaze incorporating about 7% Fe_3O_4 are considered in detail. In common with other semiconducting materials, the glazes have a surface resistivity ρ which varies with temperature so that $\rho=\rho_0 e^{b/T}$, ρ_0 and b being constants. Disintegration of the glaze (due to cumulative current rise) occurs when the applied voltage exceeds a certain limiting value.

621.315.612.4 : 546.431.82 : 537.228.2 **1062**

Electrostrictive Effect in Barium Titanate.—W. P. Mason. (*Phys. Rev.*, 1st Nov. 1947, Vol. 72, No. 9, pp. 869–870.) The radial and thickness modes of disks have been examined and the electrostriction constants plotted for ascending and descending voltage gradients ; a mechanism for the ' thickness effect ' is deduced. See also 3547 of 1947 (Roberts).

621.316.99 **1063**

Some Aspects of Earthing.—R. E. Rimes. (*P.O. elect. Engrs' J.*, Oct. 1947, Vol. 40, Part 3, pp. 130–134.) Three factors affect the resistance of earthing systems : (*a*) the soil, (*b*) the electrodes, and (*c*) the connecting leads. Practically all the resistance is in the soil ; it is largely dependent on the electrolytes present and is extremely variable. Formulae are derived for the resistances of spherical, rod and strip electrodes.

669.35.24 **1064**

Nickel-Bearing Copper.—(*Metal Ind., Lond.*, 10th Oct. 1947, Vol. 71, No. 15, p. 301.) A high-conductivity temper-hardened alloy consisting of 1%Ni, 0.2%P, 0.2%S, and the remainder Cu. Physical and mechanical properties are listed.

679.5 **1065**

Investigation of the Resistance to Impact Loading of Plastics.—H. Liander, C. Schaub & A. Asplund. (*ASTM Bull.*, Oct. 1947, No. 148, pp. 88–94.)

679.5 : 621.3 **1066**

Plastics for Electrical and Radio Engineers. [Book Review]—W. J. Tucker & R. S. Roberts. Technical Press, Kingston, Surrey, England. 2nd edn, 167 pp., 15s. (*Electrician*, 31st Oct. 1947, Vol. 139, No. 3620, pp. 1299–1300.) A survey of the more important compounds and a guide to the design of electrical components embodying plastics. " An excellent general introduction to a complex subject, and contains much information of value, equally to the student and the manufacturer." See also 2952 of 1946.

MATHEMATICS

517.512.2 : 518.4 **1067**

Graphical Fourier Analysis.—T. C. Blow. (*Electronics*, Dec. 1947, Vol. 20, No. 12, pp. 194.. 198.) Ordinates $a_1 \ldots a_n$ are marked off at equal intervals of the independent variable. The resultant of a_1 in direction $(360/n)^\circ$, a_2 in direction $2 \times (360/n)^\circ$, etc. is $A_1 n/2$ in direction ϕ_1°. The resultant of a_1 in direction $2 \times (360/n)^\circ$, a_2 in direction $4 \times (360/n)^\circ$ etc. is $A_2 n/2$ in direction ϕ_2°, and so on, the required series being

$$A_0 + A_1 \sin (\theta + \phi_1) + A_2 \sin (2\theta + \phi_2) + \text{etc.}$$

517.512.2 : 621.396.67 **1068**

Fourier Transforms in Aerial Theory : Part 4 — Fourier Approximation Curves.—J. F. Ramsay. (*Marconi Rev.*, July/Sept. 1947, Vol. 10, No. 86, pp. 81–90.) Continuation of 155 of January. Fourier approximation curves are derived for a rectangular waveform. Gibbs' phenomenon is discussed. The transition from Fourier series to Fourier integral is shown graphically by finding the frequency spectrum of recurrent waveforms with gradually lengthening period, ending with a single pulse. By a change of notation, the transient analysis of circuit theory can be interpreted as the Fourier transform theory of aerials.

The approximation curve to a rectangular pulse obtained by restricting the frequency range of the spectral envelope is considered. The aperture distribution appropriate to a 'sectoral' beam is also calculated.

517.544 **1069**

Schwarz' Inequality and the Methods of Rayleigh-Ritz and Trefftz.—J. B. Diaz & A. Weinstein. (*J. Math. Phys.*, Oct. 1947, Vol. 26, No. 3, pp. 133–136.) "Both the Rayleigh-Ritz method and the Trefftz procedure can be derived, in the case of quadratic functionals, by a simple and direct application of Schwarz' inequality and Green's formula." Application to other boundary problems is possible.

518.5 : 517.9 **1070**

A Device for the Solution of Ordinary Differential Equations.—I. S. Bruk. (*C. R. Acad. Sci. U.R.S.S.*, 30th Aug. 1946, Vol. 53, No. 6, pp. 523–526. In English.) An electrical differential analyser whose integrating element is a RC circuit of large time constant. It is simpler though less accurate than a mechanical integrator. Variables are represented by the voltages of busbars. The operation of the instrument is explained by means of illustrative examples, and compared with that of a mechanical analyser.

518.5 : 517.942.9 **1071**

A Resistor Network for the Approximate Solution of the Laplace Equation.—D. C. DePackh. (*Rev. sci. Instrum.*, Oct. 1947, Vol. 18, No. 10, pp. 798–799.) A device more convenient in some respects than the electrolyte tank, if some degree of approximation in the solution may be tolerated. The two-dimensional Laplace equation requires for its solution a network of equal resistors which form a series of squares, one resistor to each side of a square. For the axially-symmetric form of the equation it is necessary to graduate the values of the resistors in the two perpendicular directions parallel to the sides of the elementary squares, of which there may be some 200 to 240. In both cases an electrical bond is made at each corner of each square, and the potential at any point, when a suitable voltage is applied across the network, may be measured either by a valve voltmeter or a potentiometer, according to the accuracy required.

518.5 : 621.317.733 **1072**

Bridge Type Electrical Computers.—W. K. Ergen. (*Rev. sci. Instrum.*, Aug. 1947, Vol. 18, No. 8, pp. 564–567.) Full paper. Summary abstracted in 2165 of 1947.

518.61 : 621.392 **1073**

A Computational Method applicable to Microwave Networks.—R. H. Dicke. (*J. appl. Phys.*, Oct. 1947, Vol. 18, No. 10, pp. 873–878.) "A method is devised for computing the properties of a complex microwave network in terms of the properties of the circuit elements which in combination form the network. It is particularly suited to machine computation of the properties of circuits of such complexity that simpler, more direct methods fail. It is also applicable to low-frequency networks. The elements of such networks may be regarded as interconnected by transmission lines of zero length. A numerical example is used to illustrate the method."

518.5 **1074**

The Theory of Mathematical Machines. [Book Review]—F. J. Murray. King's Crown Press, New York, 1947, 116 pp., $3.00. (*Rev. sci. Instrum.*, Oct. 1947, Vol. 18, No. 10, pp. 786–787.) "...Goes a long way toward providing a connected picture of the work that has been done in the field prior to the development of electronic devices."

MEASUREMENTS AND TEST GEAR

621.317.3 **1075**

Measurement of Capacitance, Inductance and Resistance with the Double Voltage Divider.—O. Zinke. (*Funk u. Ton*, 1947, No. 1, pp. 11–20.) A detailed explanation of the method as applied to very large or very small capacitors, and self or mutual inductors.

621.317.3.029.64 + 621.317.7.029.64 **1076**

Contribution to the Study of Methods and Apparatus for Measurements in the Centimetre Wave Band.—M. Denis & R. Liot. (*Ann. Radioélect.*, Oct. 1947, Vol. 2, No. 10, pp. 409–438.) The first of a series of articles discussing the theory and technique of u.h.f. measurements. A brief discussion of the distinctive character of such measurements, with an exhaustive treatment of the properties of transmission lines and of detectors for stationary waves. Application is made to the determination of the Q and the shunt impedance of cavities such as those of the rhumbatron. Practical details are discussed.

621.317.33.011.5 : 546.212-16 **1077**

Dielectric Loss of Ice.—F. X. Eder. (*Funk u. Ton*, 1947, No. 1, pp. 21–29.) Measurements of the dielectric constant and loss factor were made between 0°C and –50°C for frequencies from 50 c/s to 3 000 Mc/s. With increase of frequency the dielectric constant falls rapidly from its initial value of about 80 to a value near 2. This low value is reached at about 10 kc/s for a temperature of –50°C and at about 100 kc/s for –3°C. The loss factor (tan δ) curves all have a high maximum, which occurs at a lower frequency with decrease of temperature. For –3°C the maximum value is about 2.4 and occurs near 40 kc/s, while for –50°C the maximum is about 2.1 near 1 500 c/s. For very high frequencies both the dielectric constant and the loss factor show little variation with frequency.

Comparison of the results with Debye's dipole theory of fluid dielectrics shows very good agreement when account is taken of the effect of crystallization, which makes the internal friction, and consequently the molecular relaxation time, appreciably greater for ice than for water. The results are briefly discussed with regard to (*a*) the effect of icing on the radiation from aerials and on carrier telephony on overhead lines, and (*b*) e.m. wave propagation through ice clouds. See also 2845 of 1947 (Lamb).

621.317.335.029.4 + 621.317.373.029.4 **1078**

On a Method of measuring Very Small Variations of Capacitance and Phase Angle in the Tone- and Low-Frequency Range.—L. Wegmann. (*Helv. phys. Acta*, 25th Oct. 1947, Vol. 20, Nos. 4/5, pp. 405–440.) A coincidence method is described in detail. Sensitivity for capacitances of the order of 100 pF is about the same as with bridge methods, but is definitely superior for capacitances of only a few pF. A disadvantage is that owing to the use of multivibrators, only a narrow frequency range is possible without modification of the equipment.

621.317.336.1 : 621.385.3/.5 **1079**

The Measurement of Dynamic Mutual Conductance of Valves using the Grounded-Grid Triode Mode of Operation.— E. F. Good : H. W. Lamson : F. Gutmann. (*J. sci. Instrum.*, Nov. 1947, Vol. 24, No. 11, pp. 303–304.) Discussion on 3576 of 1947 (Gutmann) and the author's reply.

621.317.35 **1080**

The S.A.C.M. Type 2128 High-Speed Level Recorder.—R. Blondé & P. Herreng. (*Câbles & Transmission, Paris*, Oct. 1947, Vol. 1, No. 3, pp. 257–260. With English summary.) A description of apparatus for recording the envelope of a complex voltage, the spectrum of which may extend from 30 c/s to 20 kc/s, with an amplitude range of about 10 000 : 1. Applications to the recording of transients and of frequency response curves, and to reverberation-time measurements, etc., are indicated.

621.317.35 : 621.396.645 **1081**

Square Wave Analysis at Audio Frequencies.—J. P. Van Duyne & M. E. Clark. (*Audio Engng*, May 1947, Vol. 31, No. 3, pp. 27–29 . . 52.) Examples are given of the application of square-wave technique in testing amplifiers designed for particular purposes. In production testing the response curve of an amplifier may be compared with the curves given by two others with characteristics representing the upper and lower acceptance limits. A sequence switch enables all three curves to be seen on a c.r.o. Phase/frequency characteristics can also be studied ; curves are given for a typical amplifier, with and without feedback.

621.317.384 + 621.317.43 **1082**

Iron-Loss Measurements [by a.c. bridge and calorimeter].—J. Greig & H. Kayser. (*Elect. Times*, 27th Nov. 1947, Vol. 112, No. 2925, pp. 626–627 : *Electrician*, 28th Nov. 1947, Vol. 139, No. 3624, p. 1573.) Summaries and discussion of I.E.E. paper. The calorimeter method is designed to check the results of measurements by an Owen bridge under conditions involving appreciable nonlinear distortion. Non-incremental a.f. excitation is used ; the specimen is in the form of a ring.

621.317.44 : 621.315.14 **1083**

The Measurement of the Magnetic Properties of Fine Wire.—P. T. Hobson, E. S. Chatt & W. P. Osmond. (*Electronic Engng*, Dec. 1947, Vol. 19, No. 238, pp. 383–388.) Details of apparatus used to present 50-c/s $4\pi I/H$ and B/H curves on a c.r. tube, for wires of diameter 0.004 inch. A maximum field of 1 000 oersteds is available for remanence and coercivity measurements. Readings of remanence as low as 100 gauss can be made. An appendix describes, with the aid of photographs, the advantages of the differential forms of the above curves, when applied to the magnetic analysis of alloys.

621.317.714 **1084**

The Polar Ammeter : A New Alternating Current Measuring Instrument.—E. B. Brown. (*J. sci. Instrum.*, Aug. 1947, Vol. 24, No. 8, pp. 197–198.) A moving-coil instrument, in which an alternating flux is provided in the magnet system by means of a 2-pole magnet, coupled to a synchronous motor driven from the source supplying the currents to be measured. The r.m.s. value of the current (component at fundamental frequency) and its phase are directly indicated when suitable adjustments are made to the angular position of the motor stator. The properties and advantages of the instrument are briefly discussed.

621.317.715 **1085**

New Type of Moving-Coil Galvanometer with Adjustable Sensitivity.—G. Dupouy. (*C. R. Acad. Sci., Paris*, 22nd Dec. 1947, Vol. 225, No. 25, pp. 1290–1292.) In this instrument, the torsional couple of the classical galvanometer is opposed by a magnetocrystalline couple which can be varied within wide limits. This couple is due to the action of an auxiliary magnetic field on a small cylindrical crystal of siderite ($FeCO_3$), centred on the axis of rotation. The mass of the crystal is about 10 mg, so that increase of moment of inertia is negligible. Variation of the auxiliary magnetic field is effected by screw adjustment of a magnetic shunt across the poles of an auxiliary magnet. Sensitivity data are given for two instruments with sensitivity variations of the order of 7 : 1 and 4 : 1 respectively.

621.317.725 **1086**

A General Purpose Valve Voltmeter.—F. Gutmann. (*Proc. Instn Radio Engrs, Aust.*, Oct. 1947, Vol. 8, No. 10, p. 15.) Discussion on 477 of February.

621.317.75 : 621.391.63 **1087**

The Modulation of a Beam of Light by a Sector Wheel and a Method of Testing the Waveform.—D. T. R. Dighton, H. M. Ross & A. L. Shuffrey. (*J. sci. Instrum.*, Aug. 1947, Vol. 24, No. 8, pp. 202–205.)

621.317.755 **1088**

Oscilloscope for Very Low Frequencies.—F. Juster. (*Toute la Radio*, Oct. 1947, Vol. 14, No. 119, pp. 270–274.) Full circuit details and lay-out of an instrument for operation from 3 c/s to 10 kc/s. A feature of the push-pull amplifier (which uses triodes for all stages except the output, where pentodes are used with screen connected to anode) is that no capacitors are employed in any part of the circuit.

621.317.755 **1089**

The Cathode-Ray Oscilloscope.—R. Besson. (*Toute la Radio*, Oct. 1947, Vol. 14, No. 119, pp. 278–281.) An account of its use for detection of faults, in the testing of radio receivers.

621.317.755 : 621.395.813 **1090**

Simplified Intermodulation Measurement.—McProud. (*See* 947.)

621.317.755 : [621.396.619 + 621.396.813 **1091**

Alignment of an A.M./F.M. Generator.—R. Aschenbrenner. (*Radio franç.*, Nov. 1947, pp. 10–14.) Method of using a panoramic receiver and c.r.o. for modulation and distortion measurements. Oscillograms show the results obtained on actual instruments.

621.317.772 : 621.396.67 **1092**

Phase Monitor for Broadcast Arrays.—B. C. O'Brien & F. L. Sherwood. (*Electronics*, Dec. 1947, Vol. 20, No. 12, pp. 109–111.) A description of the equipment and method of operation, with diagrams. A coaxial delay line is used and readings are obtained by a null method ; calibrations are unnecessary and there is no confusion of quadrants. The phase difference between the currents in any two directional aerials can be found rapidly to within 1°. The equipment is very stable and requires no power supply.

621.317.78.029.5/.6 **1093**

A New Differential Thermometer for Use in R.F. Power Measurement.—J. Dyson. (*J. sci. Instrum.*, Aug. 1947, Vol. 24, No. 8, pp. 208–210.) "The problem of measurement of temperature rises in calorimetric measurements of r.f. power is stated, with some of the disadvantages of the existing methods." The instrument described uses a bimetallic strip immersed in each water stream, with an optical system to measure the difference between the two deflections.

621.317.79 **1094**

A Comparative Vacuum-Tube Decibel Meter.—J. H. Grieveson & A. M. Wiggins. (*Audio Engng*, May 1947, Vol. 31, No. 3, pp. 15–17.) Essentially a linear-scale direct-reading decibel meter, which may be adjusted to indicate the difference in db level between a standard and any other similar device under test. It has been found particularly suitable for testing microphones, audio transformers and amplifiers, loudspeakers, and gramophone pickups.

621.317.79 : 537.533 : 621.385.1.032.216 **1095**

Methods and Apparatus for measuring the Emission from Oxide Cathodes.—J. Riethmüller. (*Ann. Radioélect.*, Oct. 1947, Vol. 2, No. 10, pp. 329–347.) The cathodes are mounted in double diodes and, after evacuation, are submitted to a formative process at a constant temperature ; this results in a considerable improvement in the emission. After stabilization at the test temperature, about 700°C, measurements of the emission are made by a pulse method, the peak voltage normally used being 500 V, the pulse duration 100 μs and recurrence frequency 50 c/s. Full details are given of all the apparatus. The results will be given in a later paper.

621.317.79 : 621.396.615.12 **1096**

Checking M.F. and H.F. Coils with a Panoramic Analyser.—R. Aschenbrenner. (*Radio franç.*, Oct. 1947, pp. 10–14.) The analyser is used as a signal generator giving 1 mV on a frequency of 472 kc/s, with a f.m. deviation of either ± 30 kc/s or ± 20 kc/s. Details are given of the method of lining up the m.f. and h.f. circuits of a receiver.

621.317.79 : 621.396.615.12 **1097**

High Accuracy Signal Generator.—J. J. Bann. (*Electronics*, Dec. 1947, Vol. 20, No. 12, pp. 168..174.) Quartz crystal frequency control is used. A variable capacitor permits final adjustment of the frequency of the crystal circuit to exact coincidence with a frequency standard such as WWV.

621.317.79 : 621.396.615.12 **1098**

A Simplified Signal Generator.—H. G. Pratt. (*Radio News*, Oct. 1947, Vol. 38, No. 4, pp. 42–43..178.) Modulated r.f. output from 170 kc/s to 15 Mc/s in four ranges ; modulation frequency available separately.

621.317.79 : 621.396.62 **1099**

A Combined Signal Tracer and Meter.—A. R. Mitchell. (*Murphy News*, Nov. 1947, Vol. 22, No. 11, pp. 266–268.) Construction and use are discussed. The signal tracer consists of detector (probe), l.f. and output circuit and loudspeaker. The valve voltmeter consists of a double diode and a cathode-follower which can also be used for measuring resistance.

621.317.791 **1100**

Electronic Volt-Ohmmeter.—N. Péligat. (*T.S.F. pour Tous*, Oct. 1947, Vol. 23, No. 228, pp. 205–207.) Complete circuit details of an a.c. mains instrument using a 0–500-μA meter as indicator and with 6 d.c. voltage ranges (5 V to 1 000 V max.), 6 a.c. voltage ranges (10 V to 2 000 V max.) and 6 resistance ranges (R × 1 to R × 100 000).

621.396.615.17 : 621.392.5 **1101**

The Pulse-Testing of Wide-Band Networks.—D. C. Espley, E. C. Cherry & M. M. Levy. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 7, pp. 1176–1187. Discussion, p. 1218 and *ibid.*, Part III, March 1947, Vol. 94, No. 28, pp. 141–145.) The equipment contains a pulse generator, a timebase with a display unit, and an amplifier preceded by an exploring head. The generator produces three types of pulse, one of length 0.02 μs and amplitude 35 V in a cable of 35 Ω ; one of length 0.01 μs and small amplitude ; and one of amplitude variable from 50 μV to 0.5 V. The timebase produces a slow scan of 5 μs and a fast scan of 1 μs. The amplifier has a bandwidth of 32 Mc/s and a gain of 13.5 db per stage. The adjustable capacitance attenuator in the probe head has a low input capacitance of 1.8 pF at maximum attenuation. The use of the equipment for testing lines, feeders, delay lines, filters, and feedback amplifiers is discussed.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

539.16.08 **1102**

Design of Metal G-M Counters.—M. H. Shamos & I. Hudes. (*Rev. sci. Instrum.*, Aug. 1947, Vol. 18, No. 8, pp. 586–587.) A simplified design in which metallized pyrex bushings are soldered to the metal end-caps and form protective sleeves over the ends of the central wire.

539.16.08 **1103**

Discharge Spread in Geiger Counters : Part 1 — With Self-Quenching Gases.— J. D. Craggs & A. A. Jaffe. (*Phys. Rev.*, 1st Nov. 1947, Vol. 72, No. 9, pp. 784–792.) Counters consisting of a wire anode and a divided cathode of coaxial cylinders were used to measure the spread. When each cathode was closed by a glass window with a central hole, the spread was greatly reduced. It is concluded that the collimation of the photon beam by the windows precluded the photoemission from the cathodes which is mainly responsible for the spread.

539.16.08 **1104**

Equation of the Curve $I = f(N)$ relating the Luminous Flux received by Photon Counters and the Number of Discharges registered.— Lormeau. (*See* 1021.)

539.16.08 : 621.318.572 **1105**

The Model 200 Pulse Counter.— W. A. Higinbotham, J. Gallagher & M. Sands. (*Rev. sci. Instrum.*, Oct. 1947, Vol. 18, No. 10, pp. 706–715.) " A complete general purpose electronic pulse counter is described which consists of an amplitude discriminator, scale-of-64, and register driver, and is suitable for use with pulse amplifiers in making nuclear measurements."

539.16.08 : 621.385.15 **1106**

An Improved Electron Multiplier Particle Counter.— J. S. Allen. (*Rev. sci. Instrum.*, Oct. 1947, Vol. 18, No. 10, pp. 739–749.) Discussion of the design and construction of a 13-stage electron multiplier tube with overall multiplication of about 10^7.

551.464.018.4 : 534.88 **1107**

Anti-Sonar.— M. (*Elektron, Linz*, 1947, No. 7, pp. 138–139.) Temperature-dependent resistors mounted on the conning tower and near the keel of a U-boat, with a known vertical separation, constituted two arms of a Wheatstone bridge. Out-of-balance voltage was used to obtain direct readings of vertical temperature gradients. Sensitivity adjustment gave 3 ranges of 0–3°C/m, 0–6°C/m and 0–9°C/m. Tests of this equipment were not finally completed at the end of the war. A knowledge of the temperature gradient and the salinity enabled an estimate to be made of the effective sonar echo range. The use of cold-water jets to give a screening effect is discussed briefly.

615.84 **1108**

Stable Frequency Short Wave Diathermy.— R. Brennand. (*Electronic Engng*, Dec. 1947, Vol. 19, No. 238, pp. 401–403.) Diathermy apparatus designed for easy operation by non-technical personnel. Radiated energy is low enough for the apparatus to be worked without a screened room. Two models with outputs of 100 W and 500 W have been produced, incorporating crystal control of frequency and electronic tuning indicators.

615.84 : [621.365.5 + 621.365.92 **1109**

The Physics of Industrial Diathermy.— A. W. Lay. (*Electronic Engng*, July, Sept. & Nov. 1947, Vol. 19, Nos. 233, 235 & 237, pp. 227–231, 290–294 & 361–362, 364.)

620.179 : 621.317.39 **1110**

The Application of Electrical Technique to the Service of Some Other Industries.— H. C. Turner & G. M. Tomlin. (*J. Instn elect. Engrs*, Part II, Oct. 1947, Vol. 94, No. 41, pp. 501–508. Discussion, pp. 508–510.) A general discussion, with special reference to a magnetic sorting bridge for testing steel parts, a supersonic metal-thickness indicator, a vibration analyser and a supersonic flaw detector for metals.

620.179.1 : 621.317.733 **1111**

Variable-Frequency Metals Comparator.— D. E. Bovey. (*Gen. elect. Rev.*, Nov. 1947, Vol. 50, No. 11, pp. 45–49.) An improved bridge-type instrument which can be used by a technically untrained operator for the rapid sorting of specimens by comparison with a standard sample. No special preparation of the specimens is necessary and both magnetic and non-magnetic materials may be used. Spot test frequencies in the range 50–10 000 c/s are provided. Various experimental applications are discussed, including the sorting of annealed and unannealed steel bars.

620.179.16 : 534.321.9.001.8 **1112**

Ultrasonic Resonance applied to Non-Destructive Testing.— W. S. Erwin & G. M. Rassweiler. (*Rev. sci. Instrum.*, Oct. 1947, Vol. 18, No. 10, pp. 750–753.) Ultrasonic vibrations of continuously varying frequency are applied to the part under test, which is set into longitudinal vibration at its natural frequencies. The consequent reaction on the source is used to produce visible marks on a cathode-ray screen from which the thickness of the part may readily be deduced.

620.179.16 : 534.321.9.001.8 **1113**

Design of an Ultrasonic Analyzer.— A. A. McK. & F. R. (*Electronics*, Dec. 1947, Vol. 20, No. 12, pp. 102–105.) Equipment for non-destructive inspection of metal strip and production testing of uniform parts comprises a noise generator, a transmitter, piezoelectric transducers, and a recording receiver. Frequencies of 50, 440, 880, and 2 000 kc/s are used ; the position of the flaw can be marked automatically.

621.316.74 **1114**

Proportioning Temperature Controller.— D. Lazarus & A. W. Lawson. (*Rev. sci. Instrum.*, Oct. 1947, Vol. 18, No. 10, pp. 730–733.) " Unbalance voltage from a potentiometer is amplified by a simple circuit employing a 60-cycle polarized interrupter, and used to control the extent of the on-off cycle of a furnace."

621.319.339 : 621.386 **1115**

Discussion of the Practical Application of the Van de Graaff Electrostatic X-Ray Generator.— D. T. O'Connor. (*ASTM Bull.*, Oct. 1947, No. 148, pp. 57–61.) Some details of the technique used in 2-MeV radiography of bombs, shells, etc. The greatest thickness of steel penetrated was 15 inches.

621.365.5 **1116**

High-Frequency Inductive Heating.— E. C. Witsenburg. (*Tijdschr. ned. Radiogenoot.*, Nov. 1947, Vol. 12, No. 6, pp. 201–211. In Dutch, with English summary.) A simplified theoretical treatment of the energy transfer from the work coil to the work, and discussion of the efficiency of the process.

621.365.5 : 621.785.6 : 669.14 **1117**

The Surface Hardening of Steel by H.F. Induction Heating.— G. Perronne. (*Rev. gén. Élect.*, Oct. 1947, Vol. 56, No. 10, pp. 412–420.)

621.38.001.8 **1118**

Automatic Opinion Meter.—R. P. Person & T. A. Rich. (*Electronics*, Dec. 1947, Vol. 20, No. 12, pp. 142..168.) A general description of its operation, with photographs and diagrams; each unit can accommodate 120 people and measures their average opinion. Degree of opinion is expressed by operating individual dials which control potentiometers and switches in a self-balancing bridge. Allowance is made for no vote, yes, no and 50-50 opinion. The final indicator is controlled by a thyratron circuit. See also 1533 of 1947.

621.384 **1119**

Electronic Techniques in Nuclear Science.—S. A. Korff. (*Electronics*, Dec. 1947, Vol. 20, No. 12, pp. 81–87.) Description of basic electronic devices developed for accelerating particles and for observing the effects of fast-moving ions and electrons.

621.384.6 **1120**

Electrostatic Accelerator for Electrons.—W. W. Buechner, R. J. Van de Graaff, A. Sperduto, L. R. McIntosh & E. A. Burrill. (*Rev. sci. Instrum.*, Oct. 1947, Vol. 18, No. 10, pp. 754–766.) Description of the construction of a 2-MV X-ray generator. It is enclosed in a steel tank in which the gaseous insulating medium is at 200 lb/inch² pressure. A modified form, using sulphur hexafluoride as the insulator, gave a potential of 5.6 MV.

The use of a small focal spot 0.01 inch in diameter and a target current of 300 μA gave high definition and great penetration.

621.384.6 : 621.318.33 **1121**

Experiments on the Design of Synchrotron Magnets.—W. C. Parkinson, G. M. Grover & H. R. Crane. (*Rev. sci. Instrum.*, Oct. 1947, Vol. 18, No. 10, pp. 734–738.)

621.385.833 **1122**

A Corrector System in Electron Optics.—F. Bertein. (*C. R. Acad. Sci., Paris*, 3rd Nov. 1947, Vol. 225, No. 18, pp. 801–803.) Aberrations due to lens ellipticity are corrected by the use of a system of electrodes, uniformly distributed round the axis and maintained at a potential which is calculable. See also 1521, 2202 and 2531 of 1947 and 214 of January.

621.385.833 **1123**

A Method of calculating the Aberrations of Form of Electrostatic Lenses.—F. Bertein. (*C. R. Acad. Sci., Paris*, 10th Nov. 1947, Vol. 225, No. 19, pp. 863–865.)

621.385.833 **1124**

Fringing Flux Corrections for Magnetic Focusing Devices.—N. D. Coggeshall. (*J. appl. Phys.*, Oct. 1947, Vol. 18, No. 10, pp. 855–861.)

621.385.833 **1125**

Relation between [electron] **Lens Defects and Image Sharpness.**—F. Bertein. (*Ann. Radioélect.*, Oct. 1947, Vol. 2, No. 10, pp. 379–408.) A comprehensive theoretical discussion.

621.385.833 **1126**

The Optics of Three-Electrode Electron Guns.—S. G. Ellis. (*J. appl. Phys.*, Oct. 1947, Vol. 18, No. 10, pp. 879–890.) Analytical theory of a simplified electron gun. The electrodes are regarded as plane, and the variations of axial potential as linear.

621.385.833 : 537.291 **1127**

On the Determination of the Principal Elements of Electron Mirrors.—Regenstreif. (*See* 1013.)

621.395.645.33 : 578.088.7 **1128**

Electro-Encephalograph Amplifier.—E. J. Harris & P. O. Bishop. (*Wireless Engr*, Dec. 1947, Vol. 24, No. 291, p. 375.) Comment on 680 of March (Johnston).

621.396.9 : [531.714.7 + 621.395.61 **1129**

Shielding Principle provides Electronic Micrometer.—(*J. Franklin Inst.*, Oct. 1947, Vol. 244, No. 4, pp. 309–311.) Description of a micrometer developed by M. L. Greenough of the National Bureau of Standards. The current induced in a secondary winding by current flowing in a primary circuit depends upon the variable distance of the secondary from a conducting plate. This principle is used in a micrometer which gives results where a capacitance type of micrometer cannot be used; it may also be applied in microphones, speed indicators, etc.

621.398 : 623.746.48] + 623.419 **1130**

German Guided and Rocket Missiles.—E. Burgess. (*Engineer, Lond.*, 3rd–31st Oct. 1947, Vol. 184, Nos. 4784–4788, pp. 308–310, 332–333, 356–358, 381–383 & 407–409.) Details of the construction of many different types, with some information concerning their control systems.

621.398 : 631.312 **1131**

Ploughing by Radio.—S. P. Osborne & R. W. Dunn. (*Radio Craft*, Oct. 1947, Vol. 19, No. 1, pp. 20–21..64.) Description of a radio-controlled tractor plough. The experimental model was developed by Tractors Ltd. in cooperation with the Ministry of Supply and the Royal Aircraft Establishment.

PROPAGATION OF WAVES

621.396.11 **1132**

On the Use of Chernikov's Effect for the Propagation of Radio Waves.—V. L. Ginzburg. (*C. R. Acad. Sci. U.R.S.S.*, 21st April 1947, Vol. 56, No. 3, pp. 253–254. In Russian.)

621.396.11 : 551.510.535 **1133**

On the Anisotropy Effect of the Ionosphere.—Alpert. (*See* 1032.)

621.396.11.029.64 **1134**

Over-Water Refraction of 10-cm Electromagnetic Radiation.—R. B. Montgomery. (*Bull. Amer. met. Soc.*, Jan. 1947, Vol. 28, No. 1, pp. 1–8.) An account of the factors affecting nearly-horizontal propagation above a spherical earth, particularly the refraction caused by atmospheric layers close to a water surface. A formula for the dependence of refractive index on atmospheric conditions is quoted, and typical data on the variation of these conditions with height are included.

RECEPTION

621.396.621 **1135**

Quality Superheterodyne.—S. A. Knight. (*Wireless World*, Dec. 1947, Vol. 53, No. 12, pp. 472–476.) Detailed circuit and lay-out of a conventional receiver for medium and long wavelengths. Ease of construction and availability of components were considered in the design.

621.396.621 **1136**

Here's the All Plug-In Receiver.—(*Tele-Tech*, Oct. 1947, Vol. 6, No. 10, p. 57.) An a.c./d.c. set of unit construction for a.m. Each circuit is 'canned' for quick replacement.

621.396.621 **1137**

F.M. Receiver Alignment.—I. Abend. (*Radio News*, Oct. 1947, Vol. 38, No. 4, pp. 66–67..116.) The action of limiters and discriminators is explained sufficiently for successful alignment. In other respects, the procedure is similar to that for a.m. receivers.

621.396.621 : 621.396.619.11 **1138**

The Synchrodyne.—D. G. Tucker. (*Electronic Engng*, Nov. 1947, Vol. 19, No. 237, pp. 366–367.) Further notes on a receiver shown at Radiolympia (618 of February). Specifications are included for the coils used in the design of the receiver described in 525 and 526 of February. A correction to Fig. 5 of 526 is included.

For a description of the process of demodulation in the receiver see 2364 of 1947. See also 1139 below.

621.396.621 : 621.396.619.11 **1139**

The Synchrodyne.—B. Starnecki : P. K. Chatterjea : D. M. Mackay : T. H. Turney : F. Aughtie : D. G. Tucker. (*Electronic Engng*, Nov. 1947, Vol. 19, No. 237, pp. 368–369.) Correspondence on 2364 of 1947 and 525 and 526 of February (Tucker). See also 3638 of 1947 and 1138 above.

621.396.621 : 621.396.619.11 **1140**

The Synchrodyne.—(*Radio franç.*, Nov. 1947, pp. 14–16.) A description based on Tucker's account (525 and 526 of February).

621.396.621 : 621.396.681 : 621.385.1 **1141**

Tube Characteristics with 28-Volt Plate Supplies.—(*See* 1207.)

621.396.621 : 621.396.96 **1142**

The Radar Receiver.—L. W. Morrison, Jr. (*Bell Syst. tech. J.*, Oct. 1947, Vol. 26, No. 4, pp. 693–817.) Factors influencing the design of a receiver are discussed firstly from a military aspect and secondly with regard to the character of its input and output signals. The basic scheme for the generalized receiver is described and the design of its various parts is considered in detail.

The requirements of the input circuit, i.f. and video frequency amplifiers are considered. A comparison of input circuit noise for crystal and valve converters is made and the construction of several types of each, with their associated beating oscillators, is discussed. The choice of bandwidth, gain and mid-band frequency for the i.f. amplifier is considered and the design of input, interstage and second detector circuits is described with typical examples. Considerations of frequency and amplitude range for the video amplifier determine the gain characteristic, d.c. restoration methods being used to reinsert the d.c. component of the received signal.

The electrical information obtained is displayed by the radar indicator. Types of radar displays are classified and details are given of some of the c.r. tubes and deflection systems used. A description is given of sweep waveform generation, including the hyperbolic sweep for true ground-plan presentation, and range marker circuits of the liquid-tank and phase-shift types.

Typical a.f.c. and a.g.c. circuit designs and l.v. and h.v. power supplies are described and illustrated.

621.396.621.53 **1143**

A 5-10 Converter for the R.1155.—G. Elliott. (*Short Wave Mag.*, April 1947, Vol. 5, No. 2, pp. 107–111.) Circuit and construction details. A grounded-grid r.f. stage is used, coupled to an 80-Ω aerial feeder.

621.396.621.54 + 621.396.619 **1144**

Additive and Multiplicative Mixing.—J. W. Whitehead. (*Wireless World*, Dec. 1947, Vol. 53, No. 12, pp. 486–487.) Comment on 235 of January (Mitchell). See also 1145 below.

621.396.621.54 + 621.396.619 **1145**

Heterodyning and Modulation.—M. G. Scroggie : K. R. Sturley. (*Wireless World*, Nov. & Dec. 1947, Vol. 53, Nos. 11 & 12, pp. 448 & 488.) Comment on 235 of January (Mitchell). See also 1144 above.

621.396.81 : 621.396.96 **1146**

Signal/Noise Ratio in Radar.—M. Levy. (*Wireless Engr*, Dec. 1947, Vol. 24, No. 291, pp. 349–352.) On a standard radar receiver display weak pulses are detected as a rise in the mean level of the noise on the timebase. By using a limiter to prevent the spot deflection from exceeding a certain amount, a bright line is formed whose brilliance increases when a pulse is present. It is shown statistically that the visibility of small pulses is thus appreciably increased.

621.396.82 : 621.396.619.13 **1147**

Interference Problems in Frequency Modulation.—F. L. H. M. Stumpers. (*Philips Res. Rep.*, April 1947, Vol. 2, No. 2, pp. 136–160.) " After a survey of definitions, the general problem of interference with frequency-modulated signals is treated. Special attention is paid to the pauses of the desired signal. The case of equal amplitudes gives rise to some interesting mathematical relations. The loudness level of disturbances is computed. In the last two sections the interference caused by synchronised transmitters (or by two-path transmission of one signal) is extensively dealt with. Many numerical examples illustrate the theory." See also 2221 of 1947.

621.396.823 **1148**

Ignition Interference : Part 2 — Methods of Suppression.—W. Nethercot. (*Wireless World*, Dec. 1947, Vol. 53, No. 12, pp. 463–466.) Complete screening is effective but introduces special difficulties. Resistor suppression is easier and may give 40–50 db reduction. 'Concentrated' resistors of 5–15 kΩ are used between the coil and the distributor and at the plugs. Resistance distributed along special cable is more effective but is not economical. Typical results for two cars are given in the frequency range 30–650 Mc/s and the design of suppression components is discussed. Part 1 : 253 of January.

STATIONS AND COMMUNICATION SYSTEMS

621.39 : 384 **1149**

The General Planning and Organization of Colonial Telecommunication Systems.—C. Lawton & V. H. Winson. (*J. Instn elect. Engrs*, Part III, July 1947, Vol. 94, No. 30, pp. 245–251. Discussion, pp. 251–259.) Deals mainly with economic and personnel problems. Summary, *ibid.*, Part I, Aug. 1947, Vol. 94, No. 80, pp. 379–380 ; see also 1209 of 1947.

621.39 : 620.193.21 **1150**

The Development and Design of Colonial Telecommunication Systems and Plant.—C. Lawton & V. H. Winson. (*J. Instn elect. Engrs*, Part III, July 1947, Vol. 94, No. 30, pp. 229–244. Discussion, pp. 251–259.) Discussion of the design of plant and components for the tropics. Summary, *ibid.*, Part I, Aug. 1947, Vol. 94, No. 80, pp. 380–381 ; see also 1209 of 1947.

621.391.63 : 621.317.75 **1151**

The Modulation of a Beam of Light by a Sector Wheel and a Method of Testing the Waveform.—D. T. R. Dighton, H. M. Ross & A. L. Shuffrey. (*J. sci. Instrum.*, Aug. 1947, Vol. 24, No. 8, pp. 202–205.)

621.395.44 **1152**

F.M. Short Range Carrier System.—E. H. B. Bartelink & E. Daskam. (*Electronics*, Dec. 1947, Vol. 20, No. 12, pp. 112–117.) A simple system for open-wire lines 20 to 30 miles long operates in the range 100–400 kc/s. Wide-band f.m. and limiting are used to minimize audio gain variations due to climatic changes.

621.395.44 **1153**

Carrier and Pilot Current Terminal Equipment for the Secondary Groups of the 60-Channel Paris-Vierzon Coaxial Cable.—P. Moll. (*Câbles & Transmission, Paris*, Oct. 1947, Vol. 1, No. 3, pp. 227–243. With English summary.) A detailed description, with block and circuit diagrams, of equipment developed in the laboratories of the French P.T.T. and tested on the Paris-Vierzon cable ; it will be used later for the Paris-Toulouse service. All the frequencies used are multiples of 4 kc/s, derived from an oscillator of very high stability. Two pilot frequencies of 300 kc/s and 304 kc/s respectively are transmitted ; their difference frequency is used for direct control of local oscillators.

621.396.1 **1154**

Atlantic City Conference.—(*R. S. G. B. Bull.*, Nov. 1947, Vol. 23, No. 5, pp. 93–94.) Amateur frequency bands assigned at the Atlantic City Conference. The three regions into which the world is divided are defined and the services to which each band is allocated are listed.

621.396.1 **1155**

New Frequency Allocations Set.—(*Tele-Tech*, Oct. 1947, Vol. 6, No. 10, pp. 29–30.) Frequency allocations for the Western hemisphere agreed at the international conference at Atlantic City in May 1947 are tabulated and briefly discussed.

621.396.1 **1156**

International Frequency Allocations.—(*Wireless World*, Nov. 1947, Vol. 53, No. 11, p. 439.) A brief summary of frequency allocations affecting the 'European' Region as decided at the International Telecommunications Conference at Atlantic City.

621.396.5 **1157**

Radio Telephone Terminals.—H. Jefferson. (*Marconi Rev.*, July/Sept. 1947, Vol. 10, No. 86, pp. 91–101.) The essential requirements for long-distance v.h.f. R/T terminals are discussed and the merits of hybrid transformers and anti-surging devices are examined in detail. Practical systems in use are described and compared. The various methods of obtaining privacy in R/T systems are also briefly outlined. See also "Terminal Equipments", by F. M. G. Murphy, *Marconi Rev.*, May–Aug. 1934, Vol. 4, Nos. 48 & 49, pp. 20–29 & 1–10.

621.396.5 **1158**

Modern Single-Sideband Apparatus of the Dutch P.T.T.—C. T. F. van der Wyck. (*Tijdschr. ned. Radiogenoot.*, July 1947, Vol. 12, No. 4, pp. 127–149. Discussion, pp. 150–151. In Dutch, with English summary.) A short description of early equipment is followed by discussion of the principles and advantages of the equipment now used. Frequency correction is discussed theoretically and practically ; the conditions for a stable correction circuit are derived. See also 2118 of 1938 (Koomans).

621.396.61/.62 **1159**

Adapting the TBY-7 for Amateur Use.—W. B. Ford. (*Radio News*, Oct. 1947, Vol. 38, No. 4, pp. 39–41, 201.) Details of the easy modifications necessary to adapt this war-surplus portable transmitter-receiver unit for amateur use on 28 Mc/s and 50 Mc/s.

621.396.619.11/.13 **1160**

Comparison of A.M. and F.M.—M. G. Scroggie : I. F. Macdiarmid. (*Wireless Engr*, Dec. 1947, Vol. 24, No. 291, pp. 374–375.) Comment on 3660 of 1947 (Nicholson). It is emphasized that both systems must be considered on their merits for any particular application. Tests have shown that when a f.m. receiver is on tune there is little to choose between it and a similar a.m. receiver with a series-shunt limiter. See also 4030 of 1947 (Bell) and 543 of February (McKenzie).

621.396.619.16 **1161**

Coded Pulse Modulation minimizes Noise.—F. R. (*Electronics*, Dec. 1947, Vol. 20, No. 12, pp. 126–131.) Microwave signals are transmitted as a series of identical, but differently spaced pulses. To regenerate the signal, the repeater transmits a locally-generated pulse whenever it receives a noisy pulse, but remains inactive otherwise. The sampling and quantizing methods whereby voice signals are converted into pulse codes are described. A novel c.r. coder tube is used ; full details are given. See also 818 of March and back references.

621.396.65.029.64 : 621.316.726.029.64 **1162**

Simplified Microwave A.F.C. : Part 2.—Jenks. (*See* 1196.)

621.396.931 **1163**

New Police Radio.—(*Wireless World*, Dec. 1947, Vol. 53, No. 12, pp. 457–459.) A two-station a.m. diversity system with radio-link control, used to cover Hertfordshire. A 10-W 144.3-Mc/s transmitter at headquarters controls and modulates two 100-W transmitters located at opposite sides of the county. They have a frequency separation of 10 kc/s centred about 80 Mc/s and the mobile receivers have bandwidth 40 kc/s with the audio response limited to 5 kc/s. The return 98.5-Mc/s link from the cars remotely controls a low-power transmitter at each of the two stations, which communicate with headquarters on frequencies of 154.3 and 154.8 Mc/s respectively, the outputs from the two receivers at headquarters being combined. 50-μs delay networks are used at the nearer station to compensate approximately for the path difference.

621.396.931 **1164**

Portable Inductive Radiophone.—W. R. Triem. (*Electronics*, Dec. 1947, Vol. 20, No. 12, pp. 93–95.) A general account of f.m. equipment for 80 and 144 kc/s. Train-to-train communication up to 2 miles is possible; train-to-station communication up to 20 miles. Output to the loop aerial is 2½ W.

621.396.931 **1165**

Mobile Radiophone for Taxicabs proves Its Worth.—(*Tele-Tech*, Oct. 1947, Vol. 6, No. 10, pp. 52–54.) A description of a low-power f.m. system operating in the 152-Mc/s band. The phase-deviation principle is used for generating the f.m. carrier. The receivers use the Foster-Seeley discriminator circuit preceded by a double limiter; the sets are designed for ±20 kc/s deviation and an a.f. range from 350 c/s to 5 000 c/s within ±2.5 db.

621.396.933 + 621.396.663 **1166**

New Radio Compasses.—(*See* 1036.)

SUBSIDIARY APPARATUS

621.313.3 : 621.396.931 **1167**

A.C. Automotive Generator System for High Output.—(*Tele-Tech*, Oct. 1947, Vol. 6, No. 10, pp. 55–56, 93.) The elements of the system are a generator producing a.c. instead of d.c., a dry-disk rectifier which converts the a.c. to the d.c. normally used in vehicles, and a voltage regulator unit.

621.314.5 **1168**

Vibrator for Conversion of D.C. to A.C.—(*J. sci. Instrum.*, Nov. 1947, Vol. 24, No. 11, p. 306.) A non-synchronous type having contact springs tuned to 3 times the frequency of the reed. The effect is to eliminate chatter and increase contact pressure. A time efficiency (ratio of on-contact to total time) of 90% is claimed.

621.316.722.1 : 621.316.86 **1169**

The Use of Non-Linear Resistors for Voltage Correction.—G. T. Baker. (*Strowger J.*, May 1947, Vol. 6, No. 2, pp. 73–78.) "Outlines the mathematical theory of the application of carborundum-ceramic resistors for voltage correction purposes, and analyses the operational characteristics of various circuits embodying them when subjected to small fluctuations upon a steady voltage."

621.316.722.1 : 621.396.712 : 384 **1170**

Voltage Regulation in Broadcast Stations.—L. L. Helterline, Jr. (*Communications*, Nov. 1947, Vol. 27, No. 11, pp. 12–13, 37.) Various applications are briefly discussed, with emphasis on reduction of operating expenses.

621.352.3 **1171**

Recent Progress in the Study and the Manufacture of Electric Cells.—G. Génin. (*Rev. gén. Élect.*, Oct. 1947, Vol. 56, No. 10, pp. 421–425.) A review of war-time improvements in cells of the Leclanché type, resulting in satisfactory operation at temperatures from −40°C to +55°C.

621.396.614 **1172**

High Frequency Inductor Alternators.—A. W. Ford. (*G.E.C. J.*, Aug. 1947, Vol. 14, No. 4, pp. 190–200.) Simple analytical theory with vector diagrams. The cases of flux swinging and flux pulsating in both homopolar and heteropolar types are considered. The effect of second harmonic is also discussed.

621.396.68 : 621.314.222 **1173**

The Theory and Practice of Constant Voltage Transformers for Radio Power Supplies: Part 2.—R. H. Burdick. (*Marconi Rev.*, July/Sept. 1947, Vol. 10, No. 86, pp. 102–126.) Conclusion of 282 of January. The applications of these transformers to voltage stabilization for rectifier circuits, control of valve filament voltages and filament starting are outlined and the performance of series and parallel types of transformer is discussed. Filament starting and heating are examined in detail.

The principles outlined in part 1 may be used for frequencies up to 500 c/s. The effect of stray magnetic fields and their suppression is considered. Dimensions, costs, operating life of equipment and possible groupings of transformers are briefly discussed.

621.396.68 : 621.397.6 **1174**

Modern Methods of obtaining the Very High Voltage in Television Receivers.—(*See* 1182.)

621.396.68 : 621.397.6 **1175**

H.F. Source of High Voltage.—Besson. (*See* 1183.)

621.396.69 : 621.315 **1176**

F.M. and TV Transmission Line Installation Problems: Part 1.—J. S. Brown. (*Communications*, Nov. 1947, Vol. 27, No. 11, pp. 8–11, 39.) Discussion of special gas barriers, inner conductors and line supports, elbows, mounting fittings, clamp connectors, flanges, reducers, pressure controls, isolators, etc. To be continued.

621-526 **1177**

Servo Mechanism Fundamentals. [Book Review]—Lauer, Lesnick & Matson. McGraw-Hill, London, 277 pp., 17s. 6d. (*Elect. Rev., Lond.*, 28th Nov. 1947, Vol. 141, No. 3653, p. 802.) A textbook "written from the viewpoint of the engineer engaged upon the design of low-power remote-position-control servomechanisms".

TELEVISION AND PHOTOTELEGRAPHY

621.397(73) **1178**

Facsimile.—(*Wireless World*, Nov. 1947, Vol. 53, No. 11, p. 419.) Summary of paper noted in 289 of January (Sleeper).

621.397.5 : 535.317.25 **1179**

Television Resolution Chart.—(*Electronics*, Dec. 1947, Vol. 20, No. 12, pp. 123–125.) Prepared by the Committee of Television Transmitters of the Radio Manufacturers' Association. The chart is designed for standardizing resolution measurements; the basis of its construction and the procedure for using it are explained.

621.397.5 : 621.396.67 **1180**

All-Wave Television F.M. Antenna.—(*Radio News*, Oct. 1947, Vol. 38, No. 4, pp. 49..199.) A short, thick 128-Mc/s $\lambda/2$ dipole is connected by inductive rings to the midpoints of a long, thin 65-Mc/s $\lambda/2$ dipole. The s.w.r. along a 300-Ω transmission line terminated by the aerial is less than 4 : 1 in the 65-Mc/s band, and less than 2.8 : 1 in the 128-Mc/s band.

621.397.6 **1181**

Deflector Coil Efficiency.—W. T. Cocking. (*Wireless World*, Dec. 1947, Vol. 53, No. 12, pp. 460–462.) The power required for the magnetic deflection of a c.r. tube is deduced from first principles, assuming an ideal deflector system. A practical case is considered of a 9-inch television tube and deflector having an efficiency of 10.7% relative to the ideal. The reasons for this poor efficiency are analysed. 66.5% of the power is wasted in the end field of the coils and 13.5% in the external field. See also 573 of February (Schlesinger).

621.397.6 : 621.396.68 **1182**

Modern Methods of obtaining the Very High Voltage in Television Receivers.—(*Radio franç.*, Oct. 1947, pp. 20–23.) The high cost of satisfactory 50-c/s equipment and its relatively large space requirements have led to the adoption of two other methods : (*a*) the use of a high frequency, developed in a self-oscillator giving the necessary h.f. power, (*b*) the use of the energy developed in the fly-back of the c.r. tube sweep circuit. Suitable circuit arrangements for each of these methods are described.

621.397.6 : 621.396.68 **1183**

H.F. Source of High Voltage.—R. Besson. (*Toute la Radio*, Nov. 1947, Vol. 14, No. 120, pp. 325–326.) A 6V6 valve, with 300-V anode voltage, is used as an oscillator on a frequency of about 200 kc/s. The anode circuit is coupled to a specially wound and insulated coil, the voltage across which is rectified by a valve with good cathode-anode insulation. Voltages of 10–12 kV are easily obtained.

621.397.6 : 628.972 **1184**

Television Studio Lighting.—W. C. Eddy. (*J. Soc. Mot. Pict. Engrs*, Oct. 1947, Vol. 49, No. 4, pp. 334–341.) Description of a lighting system carried on an overhead network and remotely controlled by one engineer. The lighting intensity may be reduced without spoiling the contrast.

621.397.62 **1185**

Television at Radiolympia.—(*Electronic Engng*, Nov. 1947, Vol. 19, No. 237, pp. 348–351.) Brief details of various receivers exhibited. See also 618 of February.

621.397.62 **1186**

Television Receiver Construction : Parts 9 & 10.—(*Wireless World*, Nov. & Dec. 1947, Vol. 53, Nos. 11 & 12, pp. 420–422 & 481–482.) Part 9 : power unit ; some general notes. Part 10 : operating notes and conclusion. For previous parts see 304 of January and back references. Correction, *ibid.*, Jan. 1948, Vol. 54, No. 1, p. 19.

621.397.62 **1187**

Television Receiver Design.—R. Panton, G. W. Edwards & G. B. Townsend. (*G.E.C. J.*, Aug. 1947, Vol. 14, No. 4, pp. 200–214.) A general discussion, with special reference to a new table-model television and radio receiver, the main points of which are : (*a*) effective video response up to 2.8 Mc/s, (*b*) picture size 8 inches × $6\frac{3}{8}$ inches, (*c*) effective audio response 50 c/s to 9 000 c/s, (*d*) average sensitivity 4 μV (for 50 mW output at 30% modulation), and (*e*) power consumption 100–220 W.

621.397.62 **1188**

TV Intercarrier Sound System.—L. W. Parker. (*Tele-Tech*, Oct. 1947, Vol. 6, No. 10, pp. 26–28 . . 97.) A new television system in which the separation of the picture and sound channels does not take place until the last valve in the vision receiver. The f.m. sound signal is heterodyned with the a.m. vision carrier, giving a difference frequency of 4.5 Mc/s which is used to convey all the sound intelligence. A suitable arrangement of filters allows the 4.5-Mc/s signal to pass to the f.m. discriminator and prevents it from reaching the c.r. tube.

621.397.62 **1189**

Study of the Detection and Video-Frequency Amplification Stages for 455-Line Television Receivers.—J. Barthon. (*Télévis. franç.*, Oct. 1947, No. 30, pp. 15–18.) Continuation of 4058 of 1947. Deals with (*a*) the use of triodes, (*b*) the cathodyne (cathode follower), and (*c*) the working conditions of video amplifiers, with special consideration of stray capacitances, their measurement and correction.

621.397.62 **1190**

My First Television Receiver.—M. Fulbert. (*Télévis. franç.*, Oct. 1947, No. 30, pp. 19–27, 30.) A description, with complete circuit and construction details, of a receiver using as few valves as possible and a relatively low working voltage but giving good performance.

621.397.62 : 389.6 **1191**

Proposed Standards for Television Receivers.—M. Chauvierre. (*Radio franç.*, Oct. 1947, pp. 24–27.) Proposals made by the television commission of the technical group of the French radio industry (G.T.I.R.). Receivers are assumed to be connected to an aerial by coaxial cable of characteristic impedance 75 Ω. Definitions of sensitivity, distortion, stability, etc., are given and discussed, and tentative minimum values of these quantities are suggested for first and second grade receivers.

621.397.62 : 621.385.832 **1192**

The Choice of the Cathode Ray Tube.—L. Chrétien. (*Toute la Radio*, Nov. 1947, Vol. 14, No. 120, pp. 321–324.) Discussion of the physics and the relative merits of e.s. and e.m. deflection methods. It is concluded that e.m. deflection is particularly suitable for television receivers.

621.397.62 : 621.396.621.53.029.62 **1193**

Frequency Changing on Metre Waves in Television Receivers.—P. Roques. (*T.S.F. pour Tous*, Nov. 1947, Vol. 23, No. 229, pp. 235–238.) A discussion of the various problems involved, with suggested circuits for improved performance and a complete scheme for the frequency-changer stage, with perfect separation of the image and sound channels.

621.397.645 **1194**

Low-Frequency Correction of Video Amplifiers.—R. Charbonnier & S. Royer. (*Télévis. franç.*, Oct. 1947, No. 30, pp. 33–36.) Two correction systems are described and their advantages are discussed. Applications to pulse technique, c.r. oscillography and electrocardiography are mentioned.

621.397.5 **1195**

Television Today. [Book Review]—R. H. Norris. Rockliff Publishing Corporation, 244 pp., 21s. (*Electronic Engng*, Dec. 1947, Vol. 19, No. 238,

p. 405.) "The book will undoubtedly appeal most to the person who already has some knowledge of radio or television, and who wishes to bring himself up to date."

TRANSMISSION

621.316.726.029.64 : 621.396.65.029.64 **1196**

Simplified Microwave A.F.C. : Part 2.—F. A. Jenks. (*Electronics*, Dec. 1947, Vol. 20, No. 12, pp. 132–136.) Construction of a complete a.f.c. unit having six channels, 30 Mc/s apart near 3 000 Mc/s, with emphasis on the physical characteristics of the circuit components. Resonators using invar, nilvar, or Cu and Mo are described. Si-rectifier modulation, loudspeaker-diaphragm modulation and methods of cavity tuning are considered. Part 1 : 847 of March.

621.396.1 **1197**

Sidebands Again.—"Cathode Ray". (*Wireless World*, Dec. 1947, Vol. 53, No. 12, pp. 468–471.) Explains why a modulated wave must have more than one frequency. See also 4026 of 1947.

621.396.61.029.62 **1198**

10-Meter Mobile F.M. Transmitter.—R. Frank. (*Radio News*, Oct. 1947, Vol. 38, No. 4, pp. 44–45.. 130.) Construction details.

621.396.61.029.62 **1199**

A 600-watt Phone Transmitter.—R. P. Turner. (*Radio News*, Oct. 1947, Vol. 38, No. 4, pp. 61–63.. 146.) Description of a series cathode modulated transmitter giving 360–390 W modulated carrier-output power on the 10-, 11-, 20-, 40- and 80-m amateur bands.

VALVES AND THERMIONICS

621.383.4 : 621.395.625.6 **1200**

Lead-Sulfide Photoconductive Cells for Sound Reproduction.—R. J. Cashman. (*J. Soc. Mot. Pict. Engrs*, Oct. 1947, Vol. 49, No. 4, pp. 342–346. Discussion, pp. 346–348.) The spectral response is from 0.6 μ to 3.6 μ. The high infra-red response enables an indirectly-heated low-temperature exciter lamp to be used, with heating from an a.c. mains transformer. The frequency response drops 7 db from 30 to 10 000 c/s. The cell has a lower impedance and a higher signal/noise ratio than a Cs_2O cell and the noise level is not increased by background illumination.

621.383.42 **1201**

Additivity of the Effects of the Luminous Flux striking the Different Regions of a Selenium Photocell.—J. Terrien & C. Anglade. (*C. R. Acad. Sci., Paris*, 27th Oct. 1947, Vol. 225, No. 17, pp. 729–731.)

621.383.5 **1202**

Barrier-Layer Photocells.—J. Ortusi. (*Ann. Radioélect.*, Oct. 1947, Vol. 2, No. 10, pp. 359–378.) A review of the construction and properties of such cells, with a discussion of the various theories advanced to explain their action. It is shown that the principal characteristics can be explained by assuming the existence of a barrier layer between metal and semiconductor and by the use of an equivalent circuit. The quantum theory would appear to offer the best explanation of the observed effects. Abstracts are included of 51 relevant papers.

621.385 + 621.396.694 **1203**

New "All-Stage" Valve.—(*Wireless World*, Dec. 1947, Vol. 53, No. 12, pp. 483–484.) Sargrove-Tungsram UA55 is a combination of two beam tetrodes symmetrically arranged on either side of a common cathode. By means of suitable connections and operating potentials the valve can become (*a*) a high-impedance twin-beam tetrode, (*b*) a variable-μ valve, (*c*) a triode oscillator/tetrode mixer, (*d*) a power amplifier, and (*e*) a power rectifier. Operating conditions and characteristics are given. A special non-standard 9-pin base is used. The valve is designed to reduce manufacturing costs of receivers made under the E.C.M.E. system described by Sargrove (1913 of 1947).

621.385.1 + 621.396.69 **1204**

Miniaturization.—Adam. (*See* 1002.)

621.385.1 **1205**

Valve with Trochoidal Electronic Motion.—H. Alfvén & H. Romanus. (*Nature, Lond.*, 1st. Nov. 1947, Vol. 150, No. 4070, pp. 614–615.) In the presence of a uniform magnetic field electrons describe circular paths ; the addition of an e.s. field, perpendicular to the magnetic field, causes these orbits to drift along the direction of equipotential lines, the actual paths of the electrons being trochoidal. The type of valve considered has a number of anodes, connected together electrically but separated mechanically by screens which are individually connected through resistances to a h.v. supply. When a beam of electrons impinges on a screen it lowers its potential ; this causes an equipotential line from the cathode to terminate in the compartment comprised by the anode and the screen, so that the beam remains trapped in that compartment. Application of negative pulses to the anodes causes the beam to pass from compartment to compartment. The complete tube can therefore act as a counter, or as a selector switch. For the latter purpose compartments can be stacked in two dimensions, the selecting pulses being applied in turn to two sets of anodes.

621.385.1 **1206**

Microtubes.—H. Gernsback. (*Radio Craft*, Nov. 1947, Vol. 19, No. 2, pp. 17, 91.) A comment on the possibilities of a new subminiature valve announced by the National Bureau of Standards ; it is still in the development stage. Its size is comparable to a rice grain, yet it has an expected life of 15 000–20 000 hrs. See also 866 of March.

621.385.1 : 621.396.621 : 621.396.681 **1207**

Tube Characteristics with 28-Volt Plate Supplies.—(*Electronics*, Dec. 1947, Vol. 20, No. 12, pp. 190, 194.) Summary of 3261 of 1947 (Terlecki & Whitehead).

621.385.1.032.213 : 621.314.65 **1208**

Hot-Cathode Mercury-Vapour Valves.—R. Suart. (*Radio franç.*, Nov. 1947, pp. 19–24.) A review of the principles of operation and an account of construction technique and physical characteristics. Technical details are given of three valves, VH550, VH7400 and VH8500, which will handle maximum rectified powers of 7.2, 36 and 144 kW respectively.

621.385.1.032.216 : 621.396.619.23 **1209**

High-Vacuum Oxide-Cathode Pulse Modulator Tubes.—C. E. Fay. (*Bell Syst. tech. J.*, Oct. 1947, Vol. 26, No. 4, pp. 818–836.) Discussion of the requirements of pulse modulator valves and the choice of parameters to meet them. A range of valves developed to operate at pulse voltages up to 25 kV and currents up to 18 A is described. The chief problems encountered were sparking, cathode emission and primary grid emission.

621.385.3/.5 : 621.317.336.1 **1210**

The Measurement of Dynamic Mutual Conductance of Valves using the Grounded-Grid Triode Mode of Operation.—E. F. Good : H. W. Lamson : F. Gutmann. (*J. sci. Instrum.*, Nov. 1947, Vol. 24, No. 11, pp. 303–304.) Discussion on 3576 of 1947 (Gutmann) and the author's reply.

621.385.4 **1211**

A New Double Electrometer Valve.—G. C. Little. (*Electronic Engng*, Nov. 1947, Vol. 19, No. 237, p. 365.) An indirectly-heated tetrode in which the effects due to fluctuations in the battery supply potentials and in valve emission are considerably reduced.

The valve has a stability of 2.5 mV per 1% change in heater current, a figure which may be lowered to 0.1 mV by using a DuBridge-Brown circuit. A high degree of stability is retained over a wide range of input signal, making the valve particularly suitable for input stages in d.c. amplifiers.

621.385.832 : 535.37 **1212**

The Application of Chemically Unstable Phosphors to Cathode Ray Tubes.—R. B. Head. (*Electronic Engng*, Nov. 1947, Vol. 19, No. 237, pp. 363–364.) A method is described whereby certain phosphors which are easily spoiled by contact with a moist atmosphere, may be applied to a c.r. tube in a very short time.

The tube is completed up to the sealing-on stage and then a binder consisting of a fog of phosphoric acid droplets is admitted and allowed to settle. The surplus is blown out and the phosphor introduced as a fine powder. All the powder except a single-crystal layer may be removed by vibration and the tube is then ready for sealing on to the pumping system.

621.396.822 : 519.271 **1213**

On the Distribution of the Number of Large Deviations in Electric Fluctuations.—V. I. Bunimovich & M. A. Leontovich. (*C. R. Acad. Sci. U.R.S.S.*, 10th July 1946, Vol. 53, No. 1, pp. 21–23. In English.)

MISCELLANEOUS

001.92 : 5 **1214**

Publication and Classification of Scientific Knowledge.—(*Nature, Lond.*, 8th Nov. 1947, Vol. 160, No. 4071, pp. 649–650.) Report of a conference organized by the Cambridge Branch of the Association of Scientific Workers. The main problem is to enable scientific workers to get to know of work that interests them. A national distributing agency was suggested which in return for a subscription would supply say 1 000 papers a year, plus abstracts of a given field or fields. The relative merits of reproduction by reprinting and by microfilm were considered, and various methods of classification discussed. The need for rationalization was indicated by the fact that some 750 000 original papers appear annually in 15 000 periodicals and about one-third of them are abstracted.

026 : 5 **1215**

French Scientific Library in London.—(*Nature, Lond.*, 15th Nov. 1947, Vol. 160, No. 4072, p. 669.) Both books and periodicals can be borrowed by post from the Librarian, Scientific Library, Institut Français du Royaume-Uni, Queensberry Place, South Kensington, London, S.W.7. All library services are free. Microfilms of articles can also be obtained by the Library from France.

06.064 London : 621.396 **1216**

[Olympia] **Show Review.**—(*Wireless World*, Nov. 1947, Vol. 53, No. 11, pp. 423–438.) For other accounts see 618 of February.

621.396(47) **1217**

Survey of Russian Radio, 1917-1947.—(*Radiotekhnika, Moscow*, Nov./Dec. 1947, Vol. 2, No. 8, pp. 1–64. In Russian.) A series of papers by various authors.

621.396.67 **1218**

Who Invented the Aerial?—L. Solari. (*Wireless World*, Dec. 1947, Vol. 53, No. 12, p. 487.) Comment on 4100 of 1947. See also 1219 below.

621.396.67 **1219**

The "Elevated Electrode".—(*Wireless World*, Dec. 1947, Vol. 53, No. 12, p. 453.) A letter from Popov published in the *Electrician* of 10th Dec. 1897 does not conflict with the view that the invention of the aerial may be correctly ascribed to Marconi. See also 4100 of 1947 and 1218 above.

016 : 621.38/.39 **1220**

Electronic Engineering Master Index — 1946. [Book Review]—F. A. Petraglia (Ed.). Electronics Research Publishing Co., New York, 202 pp., $17.50. (*Gen. elect. Rev.*, Nov. 1947, Vol. 50, No. 11, p. 57.) First annual supplement to the index noted in 2108 and 3155 of 1946, covering the period July 1945 to December 1946. See also *Wireless Engr*, Dec. 1947, Vol. 24, No. 291, p. 373.

621.38/.39 **1221**

Electronic Engineering Patent Index—1946. [Book Review]—Electronics Research Publishing Co., New York, 1947, 476 pp., $14.50. (*Tele-Tech*, Sept. 1947, Vol. 6, No. 9, p. 93.) A compilation of about 2 000 patents issued in the U.S. during 1946. The first of a proposed annual series.

621.396 **1222**

Fundamentals of Radio. [Book Review]—W. L. Everitt (Ed.). Constable, London, 400 pp., 27s. 6d. (*Wireless Engr*, Nov. 1947, Vol. 24, No. 290, p. 343.) Starts 'almost at rock-bottom'. The claim to have 'covered each topic in such a way as to make clear the functioning of a complete radio system' may broadly be conceded, but to reach an engineering standard in radio a rather more solid foundation of mathematics and electricity would be necessary.

CORRECTION

In the Index to Abstracts & References 1947, Author Index, the entry against "Eckersley, T. L." should be **514,** not **51.**

ABSTRACTS and REFERENCES

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to the World List practice.

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ACOUSTICS AND AUDIO FREQUENCIES

016 : 534 **1223**

References to Contemporary Papers on Acoustics.—A. Taber Jones. (*J. acoust. Soc. Amer.*, Nov. 1947, Vol. 19, No. 6, pp. 997–1001.) Continuation of 908 of April.

534.32 : 621.395.813 **1224**

What is Good Reproduction?—(*Wireless World*, Jan. 1948, Vol. 54, No. 1, p. 20.) British Sound Recording Association discussion opened by M. G. Scroggie. Quantitative assessment of good reproduction is difficult, because the subjective opinion of the listener is necessarily involved. The ear appears to detect distortions too small to be measured. Distortions arising in loudspeakers were briefly discussed.

534.321 **1225**

The Perception of Pitch.—J. F. Schouten. (*Philips tech. Commun., Aust.*, Oct. 1946, No. 5, pp. 11–20.) Reprint of paper from *Philips tech. Rev.* noted in 1425 of 1942.

534.321.9 : 534.22 **1226**

A Precision Ultrasonic Interferometer for Liquids and Some Velocities in Heavy Water.—D. R. McMillan, Jr, & R. T. Lagemann. (*J. acoust. Soc. Amer.*, Nov. 1947, Vol. 19, No. 6, pp. 956–960.) A stabilized beat-frequency oscillator is used to generate the ultrasonic waves in the liquid. Nodal positions are detected by means of a valve voltmeter. Measurements of velocities in acetone, benzene and distilled water are compared with those of earlier workers and new measurements for heavy water at 5°, 10° and 15°C are tabulated.

534.41 **1227**

Audiometry of Normal Hearing.—C. J. LeBel. (*Audio Engng, N.Y.*, Nov. 1947, Vol. 31, No. 10, pp. 23–25, 37.) Brief details of a typical audiometer precede a description of its applications in medical, industrial and technical fields.

534.756 + 534.78 **1228**

New Possibilities in Speech Transmission.—D. Gabor. (*J. Instn elect. Engrs*, Part III, Nov. 1947, Vol. 94, No. 32, pp. 369–387. Discussion, pp. 387–390.) Two methods of frequency compression are discussed. Experimental details are given of a device for testing the quality of compressed and re-expanded speech. Compression to one-half gives full intelligibility but roughness; compression to one-sixth is intelligible but monotonous; greater compression causes loss of intelligibility. The causes of roughness and monotony are analysed; only certain 'preferred frequencies' are correctly transmitted. The reproduction is good only if one of these coincides with the pitch of the speech. In a suggested improved system the preferred frequencies are not fixed, but adjust themselves automatically to the pitch. The concept of phase is analysed. Theoretically two independent messages can be sent through the same channel by a system termed 'quadrature transmission'. See also 1057 of 1947.

534.76 + 534.85 **1229**

Stereophonic 2-Channel Transmission with the Magnetophon.—W. Lippert. (*Funk u. Ton*, Oct. & Nov. 1947, Nos. 4 & 5, pp. 173–190 & 236–250.) The general principles of stereophony are explained and the principal published theoretical and experimental results are reviewed. The construction of magnetophon apparatus for 2-channel working is described and test results are given which show that the apparatus can be improved appreciably in some respects, though in general it is well adapted for stereophonic transmission. Comparison tests of normal single-channel and stereophonic 2-channel reproduction of music and speech are discussed at length. The 2-channel system appears to have definite advantages. Other possible applications of the 2-channel magnetophon include broadcasting and high-fidelity reproduction of music.

534.78 : 621.396.662.32 **1230**

Audio Filters for the Speech Amplifier.—Galin. (*See* 1336.)

534.84 **1231**

Construction and Design of Parmly Sound Laboratory and Anechoic Chamber.—P. J. Mills. (*J. acoust. Soc. Amer.*, Nov. 1947, Vol. 19, No. 6, pp. 988–992.) General description and construction details. The 40-ton anechoic chamber is suspended on neoprene pads and has a natural frequency of about 4½ c/s. The inner surfaces are lined with wedge-shaped fiberglas blocks, and are designed to have 99% absorption for frequencies above 115 c/s. See also 3529 of 1946 (Beranek & Sleeper).

534.845 **1232**

The Application of Helmholtz Resonators to Sound-Absorbing Structures.—V. L. Jordan. (*J. acoust. Soc. Amer.*, Nov. 1947, Vol. 19, No. 6, pp. 972–981.) Theoretical and practical considerations show that sound absorbing structures using Helmholtz resonators can often be used advantageously, whether the problem is to obtain flat reverberation characteristics, to damp pronounced singularities, or to absorb sound in certain low-frequency ranges. Sizes of apertures used for absorption have been found empirically and it is shown that they do not conform to existing theory. The need for accurate formulae for the resistance term of resonators is stressed.

534.851 **1233**

The Dynamic Noise Suppressor.—J. D. Goodell. (*Audio Engng, N.Y.*, Nov. 1947, Vol. 31, No. 10, pp. 7–10..45.) Design principles and circuit details for suppressing background noise associated with the electrical reproduction of gramophone records. Control voltages proportional to the total incoming signal and noise are derived for several selected frequency bands, and are applied through reactance valves to control the frequency ranges passed by the system. The circuits are so arranged that the pass band is at its minimum value when there is no signal. A complete account was noted in 3006 of 1947 (Scott).

534.851 : 621.395.625.2 **1234**

The Design of a New Lacquer Recording Stylus.—I. L. Capps. (*Audio Engng, N.Y.*, Jan. 1948, Vol. 32, No. 1, pp. 18–20..42.) A modified design which provides two or three burnishing facets at different angles along the cutting edge. This ensures adequate burnishing of the groove walls over a greater range of groove slopes, and thus reduces the playback noise. See also 616 of 1947.

534.851.6 : 621.395.828.1 **1235**

Experimental Noise Suppressor.—C. D. Cole. (*Audio Engng, N.Y.*, Jan. 1948, Vol. 32, No. 1, pp. 9–12.) Gramophone needle hiss does not occur at frequencies much below 1.5 kc/s; at greater frequencies it has a fairly constant amplitude of approximately 40 db below the programme peaks. The suppressor described first separates the programme into four portions by means of band-pass filters covering the ranges 0–1.5 kc/s, 1.5–3 kc/s, 3–6 kc/s and 6–12 kc/s. Germanium rectifiers in all except the lowest frequency channel then suppress both programme and noise below a certain selected amplitude. Harmonic distortion is removed by a further set of octave band-pass filters before the channels are recombined.

534.86 : 534.322.1 **1236**

Frequency Range Preference for Speech and Music.—H. F. Olson. (*Broadcast News*, Sept. 1947, No. 46, pp. 28–32.) Full account of the tests already noted in 10 of January.

534.861 **1237**

New C.B.S. Program Transmission Standards.—H. A. Chinn & P. Eisenberg. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1947, Vol. 35, No. 12, pp. 1547–1555.) Full analysis of the results of experiments conducted to determine (*a*) the relative levels at which speech and music should be transmitted, and (*b*) the range within which the peak levels should lie. As a result of the tests the C.B.S. has adopted new maximum peak levels and introduced minimum levels below which the peaks should not fall. See also 3567 of 1945 (Chinn & Eisenberg).

534.861.1 **1238**

Recording Studio 3A.—G. M. Nixon. (*Broadcast News*, Sept. 1947, No. 46, pp. 33–35.) Discusses the acoustical design problems in remodelling a studio for broadcast transcription and recording. Adjustable acoustical elements are used to provide a change of reverberation time of about 2 : 1. The optimum combination of diffusely reflecting surfaces and absorbent areas is considered.

621.395.61 : 621.395.623.7 **1239**

Microphones for Loudspeaker Equipment.—E. M. Philipp. (*Radio Tech., Vienna*, 1947, Vol. 23, Nos. 8/9, pp. 411–418.) An account of the construction of various types of microphone and of their frequency characteristics, when used singly or in combination, with suitable amplifiers.

621.395.623.7 **1240**

An "F.M. Quality" Speaker.—G. E. Rand. (*Broadcast News*, Sept. 1947, No. 46, pp. 24–27.) Uses two cones having the same vertical angle and apex. The diameter of the low-frequency cone is 15 inches, and that of the high-frequency cone 2 inches. A very flat frequency characteristic over a wide range, low side tone, and good polar diagram at all frequencies are claimed. The speaker is the outcome of work by Olson & Preston (2664 of 1947).

621.395.623.8 + 621.396.61] : 621.318.572 **1241**

An Experiment in Voice Controlled Relays.—Wortman. (*See* 1502.)

621.395.625.2 **1242**

Feedback Recording Head giving Low Intermodulation.—E. Cook. (*Tele-Tech*, Nov. 1947, Vol. 6, No. 11, pp. 46–49..102.) Controllable degenerative feedback improves frequency response and stability in disk-recording gear. A magnetic cutter is used because of its cheapness and strength. The difficulties of securing efficient feedback from the last stage of the cutter amplifier are considered. Complete circuit and design details are given.

621.395.625.2 **1243**

Commercial Disc Recording.—(*Wireless World*, Feb. 1948, Vol. 54, No. 2, p. 67.) Brief summary of I.E.E. lecture entitled "Commercial Disc Recording and Processing", by B. E. G. Mittell. Proposals were made for the standardization of groove and stylus shape and of recording characteristics. In the discussion these proposals were, in general, approved. It was also generally agreed that an extended high-frequency response was desirable.

The use of vinyl plastics for the manufacture of records and the performance of sapphire points were also discussed.

621.395.625.3 **1244**

Field Measurements on Magnetic Recording Heads.—D. L. Clark & L. L. Merrill. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1947, Vol. 35, No. 12, pp. 1575–1579.) A method is described for measuring relative values of the magnetizing force along the path of the wire traversing a recording or reproducing head. Field distribution curves are shown. The frequency response is calculated and compared with the measured values. The high-frequency response depends on the sharpness of cut-off on the 'leaving' side of the gap and is independent of the shape on the 'approaching' side.

621.395.92 **1245**

Government Hearing Aid.—(*Wireless World*, Jan. 1948, Vol. 54, No. 1, pp. 11–12.) Summary of Medical Research Council Special Report No. 261: "Hearing Aids and Audiometers", published by H. M. Stationery Office. Optimum response, amplification and output were determined from numerous tests covering all types and degrees of deafness. Batteries and connectors should be standardized. Circuit and performance details are given of two prototypes made at the Post Office research station; one has a light-weight moving-iron receiver and the other a piezoelectric insert receiver. Appendices deal with audiometers and objective tests for hearing aids. For other summaries see *Brit. Med. J.*, 6th Dec. 1947, No. 4535, pp. 916–917, and 1246 below.

621.395.92 **1246**

Hearing Aid Development.—(*Elect. Times*, 11th Dec. 1947, Vol. 112, No. 2927, pp. 687–688.) Discussion of an I.E.E. paper entitled "Speech Communication under Conditions of Deafness or Loud Noise", by W. G. Radley, and of the Medical Research Council's Special Report No. 261; see also 1245 above. Hearing aids designed to have a response curve which falls off at frequencies below 1 000 c/s were tested experimentally on 63 subjects at one clinic and 165 at another. A definite improvement in intelligibility was obtained when the amplification was decreased for frequencies below 750 c/s at a rate of 12 db/octave. Further, the amplification above 4 000 c/s could be reduced at the rate of 18 db/octave. Between 750 c/s and 4 000 c/s the response should be level, or should increase slowly to a peak value at 4 000 c/s about 12 db greater than the 750-c/s amplification.

621.395.92 **1247**

Smallest Hearing Aid uses Printed Circuits.—(*Radio Craft*, Jan. 1948, Vol. 19, No. 4, pp. 66–67.) Description, with photographs and circuit diagram, of an instrument whose case measures only $4\frac{1}{8}$ inches × $2\frac{3}{8}$ inches × $\frac{7}{8}$ inch and contains amplifier and batteries.

621.395.92 **1248**

The Influence of Body-Baffle Effects on the Performance of Hearing Aids.—R. H. Nichols, Jr, R. J. Marquis, W. G. Wiklund, A. S. Filler, C. V. Hudgins & G. E. Peterson. (*J. acoust. Soc. Amer.*, Nov. 1947, Vol. 19, No. 6, pp. 943–951.) Discussion of the effect of the wearer's person on the response of a hearing aid. This baffle effect has been studied under free- and diffuse-field conditions for several different hearing aids and wearers. It does not depend greatly on the size of the wearer, nor does it appreciably reduce intelligibility. For each type of hearing aid, worn at the centre chest position in a free field, the curve relating response and frequency is plotted. In general, there is a broad peak, about 5 db in height, for the frequency range 100–1 000 c/s and a relatively narrow valley, 15–20 db in depth, for the frequency range 800–2 000 c/s. In a diffuse sound field the body-baffle effect is very small.

AERIALS AND TRANSMISSION LINES

621.315.212 : 621.392.029.64 **1249**

Plane Discontinuities in Coaxial Lines.—J. W. Miles. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1947, Vol. 35, No. 12, pp. 1498–1502.) The equivalent circuit is established as a simple shunt capacitance, which is calculated for concentric changes of cross-section and concentric disks. In order to use the results of the analogous discontinuities in parallel-plate guides, 'equivalent radii' are asymptotically calculated; the results are sufficiently accurate for most practical applications. See also 634 of 1947.

621.392.012.2 **1250**

Construction of Circle Diagrams and Their Use in solving Certain Transmission Line Problems.—I. T. Sokolov. (*Radiotekhnika, Moscow*, 1947, No. 7, pp. 57–69. In Russian.) Discussion of the use of circle diagrams for calculating the input impedance of a line, the coefficients of standing and travelling waves, etc.

621.392.029.64 **1251**

On Wave Propagation in Waveguides.—L. de Broglie. (*Radio tech. Dig., Édn franç.*, Feb. 1948, Vol. 2, No. 1, pp. 20–25.) All the solutions normally obtained for waveguide propagation can be derived by the superposition of plane waves of a certain type. An expression for the phase velocity is then easily deduced. Two methods of treating the propagation of energy along a waveguide are considered. These methods, whose equivalence is not obvious, are shown to give the same result. Certain of the formulae derived show close analogy with wave mechanics and it appears that the study of waveguide theory is of great interest not only in radio technique but also from a general scientific standpoint.

621.392.029.64 **1252**

On the Penetration of an Electromagnetic Field through a Diaphragm in a Waveguide.—M. I. Kontorovich. (*Zh. tekh. Fiz.*, 1947, Vol. 17, No. 3, pp. 269–282. In Russian.) An infinitely long tube is considered, made of perfectly conducting material and divided into two parts by a perfectly conducting diaphragm with a small central aperture (Fig. 1). It is assumed that an e.m. wave is passing from one part of the tube to the other. A differential equation (3) is derived and methods for its solution are indicated. Boundary conditions are discussed and various constants determined. Finally, a general formula (18) determining the field set up by the wave after passing through the diaphragm is derived. Particular cases are considered and the accuracy of the proposed solutions is verified experimentally.

621.392.029.64 **1253**

The Theory of Disk-Loaded Wave Guides.—E. L. Chu & W. W. Hansen. (*J. appl. Phys.*, Nov. 1947, Vol. 18, No. 11, pp. 996–1008.) "The properties of circular wave guides loaded with apertured disks are discussed both qualitatively and quantitatively. Formulae and curves are given for various quantities including the wave and group velocities, the attenuation, and the power flow."

621.392.029.64 : 621.317.791 **1254**

Simple Measuring Equipment for Flexible Waveguides.—Winchell. (*See* 1417.)

621.392.029.64 : 621.392.4 **1255**

An Adjustable Wave-Guide Phase Changer.—A. G. Fox. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1947, Vol. 35, No. 12, pp. 1489–1498.) The properties are discussed of two basic differential phase-shift sections which produce differential delays of 90° and 180° respectively between two waves polarized in planes at right angles to one another. A combination of these sections may be used to control continuously the phase of the output wave, relative to the input, with substantially 100% transmission. Application to the design of a naval Multiple Unit Steerable Antenna (MUSA: 3677 of 1937) is described. Methods for producing the differential phase-shift sections are: (*a*) distortion of a circular guide to oval cross-section, (*b*) insertion of diametrically opposed fins inside a circular guide, (*c*) insertion of a dielectric plate along the guide, and (*d*) use of lumped-element sections of guide. A mathematical analysis of the phase changer is given in an appendix.

621.392.1 : 621.3.012.2 **1256**

Transmission Line Calculations.—G. Cioni. (*Wireless Engr*, Feb. 1948, Vol. 25, No. 293, p. 64.) Comment on 337 of February (Vaughan).

621.392.41 : 621.315.212 : 621.395.822.1 **1257**

Calculation of Bridged-T Networks and Their Application to Crosstalk Reduction between Coaxial Pairs.—Baranov. (*See* 1295.)

621.392.43 **1258**

Uniform and Exponential Transmission-Lines.—B. Persoz. (*Radio franç.*, Dec. 1947, pp. 7–13.) The properties of uniform lines, for which the characteristic impedance is constant, are reviewed and solutions of the general equations are given for exponential lines, for which the characteristic impedance is an exponential function of distance along the line. An exponential line is compared with a $\lambda/4$ uniform line for impedance transformation; the exponential line is definitely superior where a considerable frequency range is to be covered.

621.392.43 **1259**

The L Network as an Impedance Transformer.—F. D. Wells. (*CQ*, Nov. 1947, Vol. 3, No. 11, pp. 38–40..84.) A non-mathematical treatment for radio amateurs of the matching of feed lines to 2-, 3- and 4-element beams. The method is simple yet versatile. Values of circuit parameters are tabulated for typical practical cases.

621.392.43 : 621.314.2.029.56/.58 **1260**

Aerial Matching Unit for H.F. Reception.—Bray, Eaton & Whitehead. (*See* 1296.)

621.396.67 **1261**

Fundamental Limitations of Small Antennas.—H. A. Wheeler. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1947, Vol. 35, No. 12, pp. 1479–1484.) The significance and use of simple fundamental formulae for aerials small compared with λ. Practical examples are given.

621.396.67 **1262**

The Design of a Ground-Plane Antenna.—G. Thompson. (*Philips tech. Commun., Aust.*, Feb. 1947, No. 2, pp. 12–16.) Description, with design graphs and sketch, of an omnidirectional aerial consisting of a $\lambda/4$ vertical rod and four horizontal rods in the form of a cross, matched to a coaxial cable by means of a coaxial stub.

621.396.67 **1263**

Slot Aerials.—D. A. Bell. (*Wireless World*, Feb. 1948, Vol. 54, No. 2, pp. 57–58.) Their properties are compared and contrasted with those of the conventional dipole. A slot in an infinite conducting sheet corresponds closely to a magnetic dipole in free space. The construction of slot arrays is explained and various applications are mentioned. See also 1335 of 1947 (Booker).

621.396.67 **1264**

On the Theory of Slot Aerials.—M. L. Levin. (*C. R. Acad. Sci. U.R.S.S.*, 21st Nov. 1947, Vol. 58, No. 6, pp. 1039–1041. In Russian.) The slot aerial is regarded as a transmission line consisting of two 'knife-edge' conductors; equations are derived determining the voltage distribution along the slot.

621.396.67 **1265**

Slot Antennas.—N. E. Lindenblad. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1947, Vol. 35, No. 12, pp. 1472–1479.) The development is described of non-protruding aerials consisting of slots, backed by resonant cavities, in the nose or wing of an aircraft. Multiple slot aerials may be adapted for lobe switching and a mechanically simple form of nutating aerial is possible. The development of aerials for altimeter and marker purposes is traced and applications in other fields are indicated.

621.396.67 **1266**

Radiation from Longitudinal Slots in a Circular Cylinder.—A. A. Pistol'kors. (*Zh. tekh. Fiz.*, 1947, Vol. 17, No. 3, pp. 365–376. In Russian.) A mathematical investigation of the radiation from identical longitudinal slots arbitrarily disposed on the surface of an infinitely long ideally conducting cylinder (Fig. 1), the diameter of which is comparable with λ. The field on the surface of the cylinder is represented by superimposed 'surface harmonics' corresponding to the terms of a Fourier series. Methods are indicated for determining the field set up at a great distance from the cylinder by a harmonic of order p; a formula (19) for this field is derived. The field set up by a system of slots is equal to the sum (21) of the fields set up by all harmonics. A formula (24) determining the total field due to a single slot is also derived and polar diagrams are plotted. The radial component E_{pr} of the field is also found (top of p. 376). See also 1267 below.

621.396.67 **1267**

Radiation from Transverse Slots on the Surface of a Circular Cylinder.—A. A. Pistol'kors. (*Zh. tekh. Fiz.*, 1947, Vol. 17, No. 3, pp. 377–388. In Russian.) A complementary investigation to 1266 above. Using the diffraction formula of Kirchhoff as modified by Sommerfeld, a formula (2) is obtained determining the E_z component of the electric field in terms of a derivative of Green's function. Having determined the latter function (formulae *6a* and *6b*) for the case of a circular cylinder, a general formula (8) is derived and methods are indicated for determining other components of the electric and magnetic fields. Using these results the components of the fields at a great distance from the cylinder are calculated. The discussion is illustrated by two examples for which polar diagrams are plotted.

621.396.67 **1268**

On the Voltage induced in a Receiving Aerial.—S. Malatesta. (*Alta Frequenza*, Dec. 1947, Vol. 16, No. 6, pp. 294–298. In Italian, with English, French and German summaries.) The relation between the voltage and the electric and magnetic fields is specified and an expression for the voltage is derived from energy considerations, taking account of reradiation.

621.396.67 **1269**

The Radiation Power and Resistance of Diffraction Aerials.—Ya. N. Fel'd. (*C. R. Acad. Sci. U.R.S.S.*, 11th May 1947, Vol. 56, No. 5, pp. 481–484. In Russian.) Discussion of an aerial consisting of a finite closed metallic surface with an arbitrary aperture and excited from inside by a linear conductor. Formulae (5) and (10) determining respectively the radiation power and resistance are derived.

621.396.67 **1270**

A Helical Antenna for Circular Polarization.—H. A. Wheeler. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1947, Vol. 35, No. 12, pp. 1484–1488.) Basically a helical coil designed so that area/turn = pitch × $\lambda/2\pi$. More complex types are analysed and the methods of coupling to transmitter or receiver circuits indicated. Use for television is suggested.

621.396.67 **1271**

An Improvement in End-Fire Arrays.—F. K. Goward. (*J. Instn elect. Engrs*, Part III, Nov. 1947, Vol. 94, No. 32, pp. 415–418.) By increasing the linear phase shift per wavelength, a narrow main beam is produced. The side lobes can be reduced to less than 18% field strength by suitable arrangement of a second array.

621.396.67 **1272**

"Cloverleaf" Antenna for F.M. Broadcasting.—P. H. Smith. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1947, Vol. 35, No. 12, pp. 1556–1563.) Four $\lambda/2$ curved elements are arranged in a clover-leaf pattern. They are excited from a common central coaxial feeder, and are equivalent to a horizontal loop. One end of each of the elements is connected to the central conductor while the other ends are bolted to the four posts of a lattice tower. Calculated and measured data are included; installation and characteristics are fully discussed.

621.396.67 **1273**

Coupling between Aerials with Direct Feed and Aerials excited by Radiation.—R. Galletti. (*Alta Frequenza*, Oct. 1947, Vol. 16, No. 5, pp. 238–241. In Italian, with English, French and German summaries.) The amplitude and phase of the currents induced in a reflector, and also the modifications of the projector radiation impedance caused by parasitic elements, are calculated by a simple and direct method.

621.396.67 : 621.3.017.143 **1274**

Dielectric Losses in Aerials.—F. X. Eder. (*Funk u. Ton*, Jan. 1948, No. 1, pp. 19–25.) Taking account of the current distribution in a vertical aerial, the dielectric loss is calculated for an aerial conductor with a cylindrical coating of material with a finite conductivity. The loss depends on the thickness of the coating and on the length l of the aerial. For the case of excitation at the foot of the aerial, the loss has a minimum value when l is an odd multiple of $\lambda/4$, and has a very large value when l is appreciably less than $\lambda/4$. The aerial efficiency obtained from the calculated aerial resistance has a maximum value for the $\lambda/4$ aerial. With decreasing aerial length the efficiency falls off slowly at first, but then very rapidly, and for very short aerials does not exceed 10–30%. The results of measurements carried out on ice-coated aircraft aerials are in good agreement with the theory.

621.396.67 : 621.317.3.029.63/.64 **1275**

An Automatic Polar Diagram Recorder.—Beck & Tibbs. (*See* 1400.)

621.396.67 : 629.135 **1276**

Measurement of Aircraft-Antenna Patterns using Models.—G. Sinclair, E. C. Jordan & E. W. Vaughan. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1947, Vol. 35, No. 12, pp. 1451–1462.) The conditions necessary for an accurate scaled-down system cannot always be satisfied and permissible approximations are considered. Practical methods of measurement and the associated equipment are described. A new method uses the energy reradiated from a receiving aerial excited by a plane wave. "The re-radiated field is distinguished from the exciting field by its modulation, which results from varying the impedance of the receiver periodically." Construction of the model aerials and methods for calibrating the patterns in absolute terms are described. The accuracy of the measurements is discussed and illustrated by typical results. Propeller modulation and other specialized problems can conveniently be studied with models. See also 2011 of 1947.

621.396.67.029.58 **1277**

I1RM's 10- and 20-m Rotary Beam Array.—V. E. Motto. (*Tecn. elettronica*, Oct. 1947, Vol. 2, No. 4, pp. 373–382. In Italian.) Construction details of a system with front-to-back ratio of 10.7 db on 20 m (three elements), and 12.1 db on 10 m (four elements).

621.396.67.029.58 **1278**

Top-Loaded Antennas.—T. M. Gordon, Jr. (*Proc. Radio Cl. Amer.*, Jan. 1947, Vol. 24, No. 1, pp. 3–6.) An account of suitable arrangements for operation at 3 Mc/s and discussion of practical tuning methods.

621.396.67.029.62 **1279**

Vertically Polarized V.H.F. Antenna Design Factors.—J. P. Shanklin. (*Communications*, Dec. 1947, Vol. 27, No. 12, pp. 14–15, 33.) A coaxially-fed dipole aerial with a gain of 2.6 db, for the frequency bands 122–136 Mc/s and 152–162 Mc/s. To cover these broad bands the diameter of the radiating members was increased to 0.025 λ. The effect on the radiation pattern of this increase was investigated with 480-Mc/s models.

621.396.671.011.2 **1280**

On the Radiation Impedance of an Electromagnetic Dipole.—J. Patry. (*Helv. phys. Acta*, 31st Dec. 1947, Vol 20, No. 6, pp. 455–458. In French.) Summary of Swiss Phys. Soc. paper. In previous papers (1344 of 1947 and back references) an effect was neglected which may be of great importance, especially in the case of dipoles for decimetre waves. A simple approximate solution, neglecting losses, is given for two metal cylinders of given length and diameter, in line and with centre feed. A detailed theoretical treatment, taking account of losses, will be given later.

621.396.671.029.64 **1281**

Microwave Antenna Measurements.—C. C. Cutler, A. P. King & W. E. Kock. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1947, Vol. 35, No. 12, pp. 1462–1471.) Methods specially suitable for u.h.f. are discussed and include the measurement of gain, beam width, minor lobes, wide-angle radiation, mutual coupling of aerials, phase, and polarization. The requirements of an aerial testing site are considered and the components of a complete measuring equipment are briefly described.

621.396.674 **1282**

Equivalence between the Fields of a Magnetic Dipole and a Frame Aerial.—A. Foschini. (*Alta Frequenza*, Oct. 1947, Vol. 16, No. 5, pp. 232–237. In Italian, with English, French and German summaries.) The e.m. field of a flat frame-aerial of any shape, whose dimensions are small compared to λ, can be transformed, by means of an extension of Stokes' theorem, to correspond with that of a magnetic dipole.

621.315+621.392.029.64+621.396.67 **1283**

Ultrahigh Frequency Transmission and Radiation. [Book Review]—N. Marchand. J. Wiley & Sons, New York, 1947, 322 pp., $4.50. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1947, Vol. 35, No. 12, p. 1528.) Theory of transmission lines, aerials, and waveguides. " The point of view is somewhat more practical than that of previous authors on the same subject."

CIRCUITS AND CIRCUIT ELEMENTS

621.314.2.029.58 **1284**

10.7 Mc/s I.F. Transformers.—J. C. Michalowicz. (*Radio News*, Dec. 1947, Vol. 38, No. 6, pp. 55 . . 144.) Primary and secondary windings, each consisting of 17 specially grouped turns of No. 28 enamelled wire, are wound on the same former and are inductively tuned.

621.314.3† **1285**

Some Notes on the Design of Magnetic Amplifiers.—A. S. Fitzgerald. (*J. Franklin Inst.*, Nov. 1947, Vol. 244, No. 5, pp. 323–362.) The gain of a single stage is calculated and the relationship between the load impedance and the power input level for optimum output is considered. If I_0 is the rectified output current when there is no input and I_s the rectified output current when a current i flows in the saturation winding, $(I_s - I_0)/I_s$ is called the stability factor : if it is small, adjustment of the compensating current must be precise. Gain, and output at optimum input impedance, are plotted as functions of input and tabulated for three typical core materials.

Different conditions are necessary to obtain (*a*) maximum gain, (*b*) maximum sensitivity, (*c*) maximum power output ; these objectives are discussed for the different core materials, assuming that power is supplied at 60 c/s. Performance of magnetic amplifiers would be improved by raising the power-supply frequency. The design of a.c. and d.c. windings, the overall performance of multi-stage amplifiers and core design are discussed. See also 960 of April.

621.314.65.015.33 **1286**

Voltage Impulses in Rectifiers.—T. Douma. (*Philips tech. Rev.*, 1947, Vol. 9, No. 5, pp. 135–146.) A detailed theoretical study of the transient phenomena, manifested in the form of voltage impulses, that can accompany the switching action of valves in a rectifier. The possible danger of these impulses to transformer and choke coils, particularly those in the power supplies of high power transmitters, is noted. The values that the impulses may attain in systems fed from single- and multi-phase a.c. are derived, using stated approximations and assumptions.

The influence of parasitic capacitances which form oscillatory circuits within a system is considered. Methods of reducing the danger of voltage impulses in valve rectifiers are indicated.

621.315.212 : 621.392.5 **1287**

Video Delay Lines.—J. P. Blewett & J. H. Rubel. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1947, Vol. 35, No. 12, pp. 1580–1584.) Continuous coaxial transmission lines are described in which the velocity of propagation is about one-thousandth of the velocity of light. These lines include a solenoidal inner conductor and an outer conductor of stranded-wire braid. Phase and amplitude distortions in such lines are discussed, and design procedures are given for lines of optimum performance under various conditions.

621.315.5.018.44+621.396.611.029.64 **1288**

Conductors and Circuits for U.H.F.—L. Ratheiser. (*Radio Tech., Vienna*, 1947, Vol. 23, No. 10, pp. 456–458.) An elementary discussion of current distribution in conductors at u.h.f., together with a description of various tank circuits.

621.317.733 : 620.178.3 **1289**

Vibrometric Circuit with Inductive Bridge.—G. Sacerdote. (*Alta Frequenza*, Oct. 1947, Vol. 16, No. 5, pp. 228–231. In Italian, with English, French and German summaries.) A formula is obtained for the voltage developed across one diagonal of a bridge in which each arm is inductively coupled to the other three arms. Such arrangements have particular application to vibration pickups.

621.318.323.2 : 518.4 **1290**

Charts for the Calculation of Premagnetized Choke Coils.—R. Feldtkeller. (*Funk u. Ton*, Nov. 1947, No. 5, pp. 227–235.) Charts for finding, for dynamo sheet steel IV, the size of core, width of air-gap, wire diameter and number of turns, given the d.c. magnetizing current, the required inductance and the permitted temperature rise.

621.392+621.385.1+621.396.694.012.8 **1291**

Circuits and Valves in Electronics: Part 2.—R. Charbonnier & J. Royer. (*Télévis. franç.*, Dec. 1947, No. 32, Supplement *Électronique*, pp. 36–40.) Discussion of principles of cathode coupling and of its use for the apparent increase of valve input impedance, apparent decrease of capacitance, increase of circuit time-constant and cathode detection. Part 1, 359 of February.

621.392 **1292**

Extensions of the Theory of Networks.—M. Prudhon & P. M. Prache. (*Câbles & Transmission, Paris*, Jan. 1948, Vol. 2, No. 1, pp. 3–13. With English summary.) Relations are established between the impedances of the branches, the coefficients of the mesh equations and the coefficients of the nodal equations. Formulae are then derived from which the nodal equations can be obtained easily when the network includes mutual-impedance couplings. The theory is applied to (*a*) a transformer, and (*b*) a valve circuit.

621.392 **1293**

Theory and Applications of Analytical Signals.—J. Ville. (*Câbles & Transmission, Paris*, Jan. 1948, Vol. 2, No. 1, pp. 61–74. With English summary.) A signal is represented by a 2-dimensional energy distribution in a domain defined by time and frequency axes. Operators analogous to those of quantum mechanics are used to find a suitable distribution. This leads to a definition of the instantaneous spectrum of a signal, and of the distribution of energy associated with a particular frequency. Time integration of the instantaneous spectrum gives the normal spectrum. The instantaneous frequency of a signal is defined, using the concept of the analytical signal derived from the actual signal by analytical lengthening, time being considered as a complex variable. The concepts of instantaneous frequency and instantaneous spectrum provide a firm theoretical basis for researches on frequency modulation, continuous harmonic analysis and frequency compression, and generally for all problems where classical harmonic analysis gives a representation inconsistent with physical reality.

621.392 : 621.396.813 : 621.396.619.13 **1294**

The Distortion of Frequency-Modulated Waves by Transmission Networks.—A. S. Gladwin. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1947, Vol. 35, No. 12, pp. 1436–1445.) A general solution is obtained by direct operational methods. Numerical examples are given. For very large deviation ratios the distortion is nonlinear and depends on the maximum frequency deviation, but for small deviation ratios the distortion is linear and independent of the frequency deviation. When the modulating wave consists of two sine waves, intermodulation distortion takes the form of a frequency modulation of the small h.f. component by the large l.f. one. The application of negative feedback to f.m. receivers is considered.

621.392.41 : 621.315.212 : 621.395.822.1 **1295**

Calculation of Bridged-T Networks and Their Application to Crosstalk Reduction between Coaxial Pairs.—N. Baranov. (*Câbles & Transmission, Paris*, Jan. 1948, Vol. 2, No. 1, pp. 75–87. With English summary.) A procedure analogous to the Tchebychef approximation method is used to design two bridged-T networks with a phase difference close to an assigned value within a given frequency band. Examples are given with 180° phase difference from 60 to 100 kc/s. Two of these networks were used to reduce crosstalk on the Brive-Cahors cable.

621.392.43 : 621.314.2.029.56/.58 **1296**

Aerial Matching Unit for H.F. Reception.—T. E. Bray, J. C. Eaton & J. W. Whitehead. (*Electronic Engng*, Jan. 1948, Vol. 20, No. 239, p. 30.) A toroidal transformer for matching a balanced 100-Ω circuit to a balanced 600-Ω circuit, or vice versa. For reception in the frequency range 2–20 Mc/s.

621.392.5 : 518.5 **1297**

The Miller Integrator and Its Derivatives.—(*Radio franç.*, Dec. 1947, pp. 21–23.) A detailed discussion of the operation of the Miller circuit and of the voltage changes which occur in its various parts. Certain modifications convert the circuit into a particular type of multivibrator, the sanatron, with an extremely linear sweep. Replacement of the two valves by a single pentode or heptode results in the phantastron, which combines the properties of the Miller circuit and the sanatron.

621.396.611.1 **1298**

The Resistance-Capacitance Oscillator.—P. G. M. Dawe. (*Engineering, Lond.*, 31st Oct. 1947, Vol. 164, No. 4266, pp. 429–432.) Long summary of British Association paper. A theoretical treatment of the transient behaviour of 3-mesh RC oscillators, using the Heaviside step-function method of analysis. Cases with genuine oscillation and those with overswing are discussed, and the responses to a constant rate of rise of input voltage and to an impulsive input are considered. The results are confirmed by observation at very low frequencies; both experimental and theoretical results are shown graphically.

621.396.611.1 **1299**

A Non-Linear Theory of RC-Generators.—K. Theodorchik. (*J. Phys., U.S.S.R.*, 1945, Vol. 9, No. 4, pp. 341–345.)

621.396.611.21 : 549.514.51 **1300**

Measurement of Equivalent Parameters of Quartz Crystals by an Oscillation Method.—Shembel. (*See* 1389.)

621.396.611.21.029.58 **1301**

V.H.F. Crystal Oscillators.—G. B. Sells. (*QST*, Nov. 1947, Vol. 31, No. 11, pp. 44–46..128.) Details of the construction and operation of experimental 30-Mc/s crystal oscillators. Performance is improved by using additional inductive feedback between anode and crystal circuits.

621.396.611.3 **1302**

On Multi-Frequency Coupled Oscillatory Circuits.—F. Kiebitz. (*Funk u. Ton*, Jan. 1948, No. 1, pp. 3–7.) In a system of two coupled oscillatory circuits, two frequencies are possible whose periods differ from those of the individual circuits. With spark excitation both frequencies occur simultaneously, but with undamped excitation only a single frequency is found. These effects are discussed for inductive, capacitive and mixed coupling between the two circuits and formulae are derived for the frequencies in the different cases.

621.396.611.3.015.3 **1303**

On the Transient Behaviour of RC Couplings.—R. Lemas. (*Télévis. franç.*, Dec. 1947, No. 32, Supplement *Électronique*, pp. 29–32.) A complete study of RC circuits in the transient state requires the operational calculus, but much useful information can be gained from a discussion based on simple physical principles. Such discussion shows that in general the RC circuit affects both amplitude and phase of the input components, and that its effect is different for the fundamental and for harmonics. For reasonably faithful transmission, $RC\omega$ should be large for the fundamental, but for obtaining short pulses from a square-wave input, $RC\omega$ should be small. The reaction between valves and the RC link is also discussed and some practical applications are examined.

621.396.611.4 **1304**

Special Circuits for V.H.F. — Cavity Resonators.—L. Liot. (*Télévis. franç.*, Dec. 1947, No. 32, pp. 25–28.) A non-mathematical account of their properties, comparing them with conventional circuits. Their use in v.h.f. oscillators is discussed and various types of coupling are described.

621.396.615 **1305**

On the Theory of the Blocking Oscillator.—K. F. Teodorchik. (*Zh. tekh. Fiz.*, 1947, Vol. 17, No. 4, pp. 435–438. In Russian.) An equation (7) determining the operation of the oscillator is derived and various characteristics are plotted. See also 977 of April (Benjamin).

621.396.615 **1306**

Autostabilized Oscillator.—J. Dieutegard. (*Toute la Radio*, Dec. 1947, Vol. 14, No. 121, pp. 16–21.) Full circuit and construction details of an oscillator for either the 5-m or the 1-m band. Stabilization by reactance valve gives practical frequency constancy for 12% variation of supply voltages. With a French 829B valve the maximum anode power is 90 W.

621.396.615 **1307**

The Theory of Ladder-Type RC Oscillators.—K. F. Teodorchik. (*Zh. tekh. Fiz.*, 1947, Vol. 17, No. 4, pp. 439–442. In Russian.) Discussion of an oscillator consisting of a valve working into a chain of RC sections, with resistors connected in parallel. A system of equations (I) is given and formulae (9), (10) and (11) determining respectively the frequency, condition of self-excitation and stationary amplitude are derived.

621.396.615 : 621.316.726.078.3 **1308**

The Synchronization (Pulling-In) of a Valve Oscillator by a Harmonic of the Fundamental Frequency.—O. A. Tkhorzhevski & B. K. Shembel. (*Zh. tekh. Fiz.*, 1947, Vol. 17, No. 2, pp. 215–230. In Russian.) The oscillator with an external e.m.f. applied to it is regarded as a generator of reactive power at the fundamental frequency. Using this conception a simple formula (16) is derived determining the pulling-in range. It follows from this formula that for relatively small values of the external e.m.f. the range is proportional to this e.m.f., to the order number of the harmonic applied and to the characteristic impedance of the circuit. Under conditions of overloading the range is independent of the attenuation of the circuit. The main principles of the design of feedback synchronized oscillators are discussed ; experimental results fully confirm the theory.

621.396.615 : 621.316.726.078.3 **1309**

Synchronization of Oscillators.—R. D. Huntoon & A. Weiss. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1947, Vol. 35, No. 12, pp. 1415–1423.) An analysis of the behaviour of a self-limiting oscillator based on an extension of Adler's differential equation (2522 of 1946) and similar to the paper noted in 3467 of 1947.

621.396.615 : 621.317.79 **1310**

Improved Wide-Band Wobbulator.—C. P. Smith. (*Tele-Tech*, Nov. 1947, Vol. 6, No. 11, pp. 42–45.) This uses the beat frequency between a fixed-frequency klystron and a klystron whose frequency is varied mechanically. A bandwidth up to 160 Mc/s can be used in the range 1–350 Mc/s. The fixed frequency klystron is modulated by a 125-kc/s square wave. Circuit diagrams are given and the merits of the system are discussed.

621.396.615.14 : 621.316.726.078.3 **1311**

Frequency Stabilization of Microwave Oscillators.—R. V. Pound. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1947, Vol. 35, No. 12, pp. 1405–1415.) See 1690 of 1947 for similar discussion.

621.396.622.71 **1312**

Improved Type of Ratio Detector.—Hayes. (*See* 1476.)

621.396.645 **1313**

Calculation of Class-C Amplifiers.—G. Gaiani. (*Tecn. elettronica*, Sept. 1947, Vol. 2, No. 3, pp. 233–242. In Italian.) An exposition of a ' method of exact calculation ', based on the anode characteristic curves for the valve used, and an ' approximate method ', using an abac. Both are illustrated by reference to the 834 transmitting valve.

621.396.645 **1314**

More Signal — Less Noise !—C. F. Bane. (*CQ*, Dec. 1947, Vol. 3, No. 12, pp. 13–17..83.) A detailed description of a double-tuned r.f. preamplifier unit incorporating a split input coupling coil to neutralize capacitive coupling, and a 6J6 twin-triode cathode-coupled amplifier stage.

621.396.645 : 518.3 **1315**

Exact Design and Analysis of Double- and Triple-Tuned Band-Pass Amplifiers.—M. Dishal. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1947, Vol. 35, No. 12, pp. 1507–1510.) Discussion on, and corrections of, 3065 of 1947.

621.396.645 : 518.4 **1316**

Valve Operating Point with Cathode Load.—E. J. Harris. (*Wireless Engr*, Feb. 1948, Vol. 25, No. 293, pp. 63–64.) The exact operating conditions of a cathode follower with a known voltage applied to the grid can be found by a graphical method, using static anode-current/anode-voltage curves.

621.396.645.029.3 **1317**

A Flexible Decade Amplifier.—D. L. Clark. (*Audio Engng, N.Y.*, Jan. 1948, Vol. 32, No. 1, pp. 13–16..39.) A laboratory test amplifier in two units. The voltage gain of each can be made equal to 100 or 10; the main unit has, in addition, a calibrated potentiometer-type attenuator. Both units have cathode-follower outputs and may be used separately or in cascade. Provision is also made for inserting an equalizer or filter between the units. Linear distortion is kept very low by using a large degree of negative feedback, and the frequency response of each unit is flat to within 1 db between 20 c/s and 20 kc/s. The noise level finally achieved was equivalent to about $2\ \mu V$ at the input to the first unit.

621.396.645.029.3 **1318**

A Modern A.F. Power Amplifier System.—(*Philips tech. Commun., Aust.*, Jan. 1947, No. 1, pp. 3–18.) A 50-W power amplifier with constant voltage output, enabling the power taken by individual loudspeakers to be set to any value by adjusting their impedances. Optimum operating conditions are obtained by using changes in anode supply voltage to regulate the screen voltage and a.f. drive.

621.396.645.029.3 : 534.78 **1319**

Converted ART/13 Speech Amplifier with Peak Clipper and Low-Pass Filter.—W. M. Scherer. (*CQ*, Dec. 1947, Vol. 3, No. 12, pp. 19–21..91.) An a.f. amplifier suitable for a small transmitter, made from war surplus equipment.

621.396.645.029.4 **1320**

Signal/Noise Ratio in Auxiliary-Wave L.F. Amplifiers.—U. Tiberio. (*Alta Frequenza*, Dec. 1947, Vol. 16, No. 6, pp. 275–293. In Italian, with English, French and German summaries.) A new method of amplification is outlined in which signals are translated into phase variations, which are subsequently expanded and applied to a phase-meter. The signal/noise ratio for such a system is calculated by application of Nyquist's formula. A 20-db improvement is to be expected compared with ordinary l.f. methods of amplification. Measurements of the dielectric constant of solutions, using the new amplifiers, are discussed.

621.396.645.029.4 **1321**

L.F. Medium-Power Amplification.—H. Gilloux. (*Radio franç.*, Jan. 1948, pp. 17–19.) Study of output stages, with and without counter-reaction, shows that in general the use of two valves in parallel is preferable to a push-pull arrangement, as it eliminates difficulties due to asymmetry of the valves, whose characteristics, even if identical at the start, do not remain identical for long.

621.396.645.2 **1322**

The Cathode-Coupled Amplifier.—K. A. Pullen, Jr. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1947, Vol. 35, No. 12, pp. 1510–1514.) Discussion on 2507 of 1946.

621.396.645.2 : 518.4 **1323**

Time-Constant, Frequency, Attenuation of Coupling Circuits.—(*Audio Engng, N.Y.*, Nov. 1947, Vol. 31, No. 10, pp. 26–27.) Graphs showing the attenuation on a decimal or decibel scale as a function of the product of the frequency and the time constant.

621.396.645.35 **1324**

D.C. Amplifier with A.C. Mains Feed.—H. Etzold. (*Funk u. Ton*, Oct. 1947, No. 4, pp. 200–205.) The possibility of operating d.c. amplifiers from a.c. mains is examined and it is shown that by the use of (*a*) valves with indirectly-heated cathodes, and (*b*) suitable voltage-stabilizing arrangements, amplifiers of high constancy can be constructed.

621.396.645.36 **1325**

Push-Pull Input Circuits: Parts 1 & 2.—W. T. Cocking. (*Wireless World*, Jan. & Feb. 1948, Vol. 54, Nos. 1 & 2, pp. 7–10 & 62–66.) Methods are described for obtaining, from an unbalanced voltage, the balanced voltage required for a push-pull amplifier. The essential differences between phase-reversal and phase-splitting circuits are discussed and circuits are given in which the resistance phase splitter is applied to a diode detector. The l.f. and h.f. equivalents of a valve circuit with equal anode and cathode load resistors are discussed and the degree of unbalance is calculated for a particular case. The cathode-follower type of phase-splitting circuit, which allows one input terminal to be earthed, is analysed. The degree of unbalance in this type of circuit can be made practically negligible by proper choice of components; suitable values are indicated. Operating conditions are considered in detail for a typical valve—EF37.

621.396.645.37 **1326**

Feedback Amplifiers.—D. Migneco. (*Tecn. elettronica*, Aug. & Sept. 1947, Vol. 2, Nos. 2 & 3, pp. 127–133 & 247–257. In Italian.) A simple explanation of feedback in general and of single-, 2-, and 3-stage negative feedback amplifiers in particular.

621.396.645.371 **1327**

Simplification of Negative Feedback Formulae.—E. G. Beard. (*Philips tech. Commun., Aust.*, Sept. 1946, No. 4, pp. 25–26.) Feedback formulae in terms of gain in the feedback loop, with application to the cathode-follower circuit.

621.396.645.371 **1328**

High-Quality Amplifier Design.—P. J. Baxandall. (*Wireless World*, Jan. 1948, Vol. 54, No. 1, pp. 2–6.) Design of an amplifier with a 10-W output, an approximately flat response from 30 to 1 600 c/s and less than 0.1% nonlinear distortion. The two 6L6G output tetrodes are fed by an anode-follower phase inverter preceded by a pentode stage. Negative feedback is applied by means of a third winding on the specially designed output transformer, details of which are given in an appendix. Tetrodes are preferred to triodes in the output stage, since they result in a more economical design of the supply unit and require less grid swing. More negative feedback is necessary with tetrodes, but this is considered an advantage, since it tends to reduce hum. Correction *ibid.*, Feb. 1948, Vol. 54, No. 2, p. 71.

621.396.645.371 **1329**

The Impedances in Counter-Reaction Amplifiers.—P. M. Prache. (*Câbles & Transmission, Paris,* Jan. 1948, Vol. 2, No. 1, pp. 15–29. With English summary.) Counter-reaction amplifiers can be regarded as servomechanisms in which the voltage or current gain is controlled by reaction on the input power. The surplus power can either be absorbed in resistors or reflected. In the latter case a considerable variation of the active input or output impedances occurs. This variation is a function of the 'return difference', which is defined and calculated from network theory. A generalization of Thévenin's theorem enables a relation to be established between active and passive impedances. This shows that for best operation the passive input and output impedances must be matched to those of the external lines. It is often advantageous to correct the attenuation distortion of transmission lines by the gain of input transformers. Reflections due to impedance mismatch can be brought within assigned limits by attenuation equalization.

621.396.645.371 : 621.396.621 **1330**

Selectivity by Counter-Reaction.—X. de Maistre. (*Radio franç.,* Jan. 1948, pp. 8–11.) Further discussion, with practical results. For earlier work see 1041 of 1947.

621.396.662 **1331**

Coil-Pack Modification.—L. Miller. (*Wireless World,* Feb. 1948, Vol. 54, No. 2, pp. 59–60.) Two-station switch selection with variable short-wave tuning. Full circuit and component details of the modifications are given for a standard 'Weymouth' 2-circuit coil pack, but the principle can be adapted for other makes.

621.396.662.2 **1332**

Theory and Design of Progressive and Ordinary Universal Windings.—M. Kantor. (*Proc. Inst. Radio Engrs, W. & E.,* Dec. 1947, Vol. 35, No. 12, pp. 1563–1570.) An extension of papers by Simon (1085 of 1946 and back references) giving more accurate results. Theoretical expressions are used to replace empirical rules. The geometrical shape of the winding is discussed and formulae are derived for the rate of progression and the gear ratio. A complete analysis is given and simple practical equations are derived. The proper number of traverses per coil revolution is a function of the coefficient of friction between the surface of the coil former and the insulation of the wire. Practical coil design procedure is outlined.

621.396.662.3 **1333**

Normal Waves in Multipolar Ladder Filters.—P. E. Krasnushkin. (*Zh. tekh. Fiz.,* 1947, Vol. 17, No. 6, pp. 705–722. In Russian.) A filter of the ladder type consisting of an infinite number of sections, each with $(N + 1)$ input and $(N + 1)$ output terminals, is considered (Fig. 1). If an e.m.f. with an arbitrary distribution of complex amplitudes is applied to the filter, then after a time a system of stationary waves will be set up, with the distribution of the amplitudes at the terminals varying from section to section. The question is whether it is possible to select the initial distribution in such a way that it will be repeated without distortion in all subsequent sections. It is shown that for a filter described by the system of equations (1) there are N different distributions and therefore N different normal waves which will pass through the filter without distortion. The effects of the parameters of the sections on the behaviour of normal waves are then investigated and a number of interesting properties are established, such as the change from continuous to damped waves when the frequency is lowered.

621.396.662.3 : 518.4 **1334**

Charts for the Calculation of Zobel Filter Attenuations.—R. Possenti. (*Alta Frequenza,* Dec. 1947, Vol. 16, No. 6, pp. 311–319. In Italian, with English, French and German summaries.) Charts are given for calculating the losses of low-pass and high-pass Zobel filters, knowing the Q factor, the coefficient m of the derived section and the ratio of the wanted to the cut-off frequency. Previous calculation of the real and imaginary parts of the ratio of the impedances of the series and shunt arms of the various sections is not required.

621.396.662.3 : 518.4 **1335**

Graphical Aid for Frequency Selectivity Calculations.—R. M. Maiden. (*Tele-Tech,* Jan. 1948, Vol. 7, No. 1, pp. 54–55.) Abac for tuned-circuit and low- and high-pass network calculations.

621.396.662.32 : 534.78 **1336**

Audio Filters for the Speech Amplifier.—J. L. Galin. (*QST,* Nov. 1947, Vol. 31, No. 11, pp. 17–20.) Design considerations for shunt M-derived low-pass filters, and construction details using standard components. These filters are required for reducing the side-bands of a R/T transmitter whether speech clipping is or is not used. See also 1981 of 1947 (Smith).

621.396.662.34 : 518.4 **1337**

Mathematical and Graphical Representation of 2-Circuit Broadcast Band-Pass Filters.—H. Frühauf. (*Funk u. Ton,* Nov. & Dec. 1947, Nos. 5 & 6, pp. 257–267 & 312–317.) Various types of band-pass filter are considered and equations are derived in general form for 2-element filters. Families of curves are given from which the filter performance can be directly obtained. Calculations are carried out for filters with inductive coupling.

621.396.662.5 : 621.396.712.2 **1338**

Design and Use of Mixing Networks.—K. C. Morrical. (*Audio Engng, N.Y.,* Nov. 1947, Vol. 31, No. 10, pp. 11–13.) The requirements of programme mixers for broadcasting are discussed. The values of various circuit constants are calculated for two types of mixer, with simplifying assumptions which are satisfied in most applications. It is stressed that unless the attenuator is correctly loaded it will not introduce the loss for which it was designed. The relative merits of the two types of mixer are discussed, and various necessary precautions are mentioned.

621.396.69 + 621.385.1 + 621.396.621 **1339**

Miniatures in Radio.—J. Slišković. (*Radio Tech., Vienna,* 1947, Vol. 23, Nos. 11/12, pp. 549–560.) An account of recent developments of miniature valves and circuit components, with photographs and a few details of miniature receivers developed in various countries. See also 866 of March and 1002 and 1206 of April.

621.396.69 **1340**

Comparative Technical Study of World-Market [radio] **Components.**—(*Radio tech. Dig., Édn franç.*, Feb. 1948, Vol 2, No. 1, pp. 26–56.) A series of articles enumerating and discussing the latest types of components available in America, Great Britain and France. The components discussed are (*a*) valves, including c.r. tubes and photocells, (*b*) resistors, (*c*) loudspeakers, (*d*) electrolytic capacitors, (*e*) paper, mica and ceramic capacitors, (*f*) variable capacitors, (*g*) transformers, (*h*) coils and cores, (*i*) measurement apparatus, including h.f. generators, valve voltmeters, distortion meters and c.r.o. apparatus.

GENERAL PHYSICS

530.145.6 **1341**

The Interaction of Radiation and Matter.—P. M. Davidson. (*Proc. roy. Soc. A*, 3rd Dec. 1947, Vol. 191, No. 1027, pp. 542–552.) " The theory will postulate a simple wave equation and interpretations, and will therefore . . . not be directly applicable to the world of nature. Use will thus be made of the general idea, due to Dirac, that it may be possible to specify some unnatural world which lends itself more readily to mathematical representation than does the real world, but which is nevertheless so simply related to the real world that the properties of the latter may be derived, by some simple and general rule, from those of the former. . . . In the unnatural world which will be proposed in the present paper there are sources and sinks of matter, but light requires no representation other than the Maxwellian wave."

535.42/.43 + 538.556 **1342**

Notes on Diffraction Phenomena.—P. M. Duffieux. (*Ann. Phys., Paris*, Jan./Feb. 1947, No. 2, pp. 95–132.) Application of the principle of the conservation of energy to the phenomena of the diffraction of light by material obstacles shows that the principle of Huyghens and the principle of interference cannot be correctly applied to the calculation of these phenomena. The above principles only give an equation for the propagation of energy in free space.

Comparison of the equations for the diffraction of light with those for beams of corpuscles shows that the vectorial quantities introduced in these equations are analogous to impulses.

Discussion of the experimental conditions in which diffraction or interference phenomena can be observed reveals two types of coherence. With Hertzian waves the characteristic frequency results from the statistical concordance of a great number of elementary actions. In the case of light and of h.f. radiation the quantum is an entity to which an absolute coherence can be attributed. Frequency is then no more than a characteristic coefficient of the photon.

537.11 **1343**

Faraday's Electrical Theory and Modern Physics.—L. Flamm. (*Elektrotech. u. Maschinenb.*, Nov./Dec. 1947, Vol. 64, Nos. 11/12, pp. 173–180.) A discussion of the intimate relations between the fundamental concepts of Faraday and modern field theories.

537.228.5 : 538.569.4.029.64 **1344**

Stark Effect in High Frequency Fields.— C. H. Townes & F. R. Merritt. (*Phys. Rev.*, 15th Dec. 1947, Vol. 72, No. 12, pp. 1266–1267.)

537.311.31.029.64 **1345**

The Conductivity of Metals at Microwave Frequencies.—B. Serin. (*Phys. Rev.*, 15th Dec. 1947, Vol. 72, No. 12, pp. 1261–1262.) At microwave frequencies, the ratio of r.f. to d.c. conductivity depends only on the ratio of electron mean free path to skin depth and falls with an increase of this quantity. The dependence of r.f. on d.c. conductivity for silver is shown for a frequency of 10^4 Mc/s.

537.525 : 538.551.25 **1346**

On the Vibrations of the Electronic Plasma.—L. Landau. (*J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 1, pp. 25–34.) Starting from an initial arbitrary non-equilibrium distribution in which the vibrations are always damped, the frequency and decrement are deduced. The response to an external periodic electric field is calculated when its frequency is either far from or close to the natural frequency of the plasma. See also 2747 of 1947 (Borgnis).

537.525.5 **1347**

The Generation of Powerful Electric Oscillations in a Low-Pressure Discharge : Part 2 — The Use of Current Interruptions in a Low-Pressure Arc for generating Undamped Electric Oscillations.—V. L. Granovski & T. A. Suetin. (*Zh. tekh. Fiz.*, 1947, Vol. 17, No. 3, pp. 291–298. In Russian.) An experimental investigation was made of the appearance of oscillations in a low-pressure discharge tube with an abrupt constriction, obtained by the use of a small aperture in a diaphragm made of a dielectric material. Details of experiments and of the tube used are given in part 1 (*ibid.*, 1946, Vol. 16, p. 1023). Experiments have shown that with an aperiodic circuit, not only oscillations of the second type (with periodic interruptions of the current ; see last oscillogram in Fig. 1) but also oscillations of the first type (see first oscillogram in Fig. 1) can be obtained. The amplitude, frequency and form of the oscillations of the second type depend on the circuit used and on the conditions of the discharge. A theory of the oscillations is proposed which is confirmed satisfactorily by experiments. It is suggested that periodic interruption of the current in the tube with an abrupt constriction (stenotron) can be used for generating powerful undamped oscillations at ultrasonic frequencies. Examples of oscillation with outputs up to 1 kW and suitable for low-voltage operation are described.

537.525.5 **1348**

The Effect of the Electric Circuit Parameters on Oscillations in Low-Pressure Arc Discharges.—T. A. Suetin. (*Zh. tekh. Fiz.*, 1947, Vol. 17, No. 7, pp. 809–818. In Russian.) Experiments were conducted on a discharge tube with a cold mercury cathode and a hot oxide cathode (Fig. 1). The effects of the following factors on self-oscillations which may appear in the circuit were investigated : (*a*) parallel connection of a capacitor, (*b*) parallel connection of a tuned circuit, (*c*) changes in the operating conditions, and (*d*) the length of the positive column of the discharge. Several oscillograms and experimental curves are shown and the results obtained are explained.

538.213 : 621.318.323.2 **1349**

Vector Permeability.—K. A. Macfadyen. (*J. Instn elect. Engrs*, Part III, Nov. 1947, Vol. 94, No. 32, pp. 407–414.) A complex or vector value is assigned to the permeability, based on hysteresis and eddy-current loss considerations. Simple relations can be found between the electrical characteristics of coils and the components of the vector permeability of their cores. Results of tests on various well-known magnetic core materials are shown graphically. The optimum design for a low-loss reactor is calculated.

538.311 : 621.318.4 **1350**

Magnetic Field Configurations due to Air Core Coils.—J. P. Blewett. (*J. appl. Phys.*, Nov. 1947, Vol. 18, No. 11, pp. 968–976.) An extensive table is given of the field component parallel to the axis of a circular loop of wire. The current distributions necessary to give uniform fields inside cylindrical or ellipsoidal coils are derived.

538.566 + 621.396.11 + 538.32 **1351**

The Field of a Plane Wave near the Surface of a Conductor.—V. A. Fock. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1946, Vol. 10, No. 2, pp. 171–186. In Russian.) The results obtained in 1412 of 1947 concerning the distribution of currents excited by a plane wave on the surface of a body are generalized in the following two main directions : (*a*) the field is determined not only on the surface of the conductor but also at distances from it small in comparison with the radius of curvature of the surface, and (*b*) the body is regarded as a good but not ideal conductor : the Leontovich conditions for the tangent components of the field are assumed valid on its surface. The method of parabolic equation (1901 of 1947) is used here. The formulae derived give a complete solution for the diffraction of a plane wave by a convex body of arbitrary shape.

538.566 **1352**

On the Propagation of Electromagnetic Waves along Infinite Dielectric Cylinders at Low Frequencies.—B. Z. Katsenelenbaum. (*C. R. Acad. Sci. U.R.S.S.*, 1st Dec. 1947, Vol. 58, No. 7, pp. 1317–1320. In Russian.) Equations (6) determining the propagation of the waves are derived and their solutions (10) and (11) are found.

538.569.4.029.64 **1353**

Microwave Spectrum Frequency Markers.—R. L. Carter & W. V. Smith. (*Phys. Rev.*, 15th Dec. 1947, Vol. 72, No. 12, pp. 1265–1266.) The main oscillator frequency is swept through that of the auxiliary to give a series of frequency marks. Spacings of 0.2 to 10 Mc/s have been used. See also 3868 of 1947 (Good & Coles).

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.74 + 551.510.535 **1354**

Ionosphere and Solar Research.—H. v. Klüber. (*Funk u. Ton*, 1947, No. 2, pp. 61–77.) A general review of present knowledge of the constitution and properties of the ionosphere and of the sun, with particular reference to the effects of solar activity on e.m. wave propagation through the ionosphere.

523.745 : 621.396.822.029.62 **1355**

Meeting of the Royal Astronomical Society [10th Oct. 1947].—(*Observatory*, Dec. 1947, Vol. 67, No. 841, pp. 201–210.) An account by Stratton of a paper by C. W. Allen entitled "Solar Radio-Noise of 200 Mc/s and Its Relation to Solar Observations", and subsequent discussion. The noise is received in the spectrohelioscope hut at Mt. Stromlo Observatory using a manually-adjusted aerial having an acceptance cone of about 30°. The general character of the incident radiation and its relation to other observed solar parameters is described. No chromospheric or photospheric features appear to have an invariable physical connection or high short-period correlation with the solar noise. Flares are not generally accompanied by radio noise, but the results suggest that the early stage of a vigorous flare when bright $H\alpha$ is wide is accompanied by an outburst of radio noise. The possibility that the noise originates high in the corona is discussed.

523.75 **1356**

A Working Hypothesis of Solar Flares.—D. S. Evans. (*Observatory*, Dec. 1947, Vol. 67, No. 841, pp. 218–223.) A comprehensive summary of the sequence of phenomena associated with flares, and discussion of a possible mechanism for reproducing many of the observed phenomena, and of observational means of checking the hypothesis. The formation in the earth's atmosphere of (*a*) cyclonic depressions, and (*b*) tornadoes and waterspouts is considered. It is suggested that conditions in solar flares are similar to those in (*b*), and that material is sucked rapidly from great depths to the solar surface.

551.510.53 **1357**

The Stratosphere.—S. Chapman. (*Weather, Lond.*, Jan. 1948, Vol. 3, No. 1, pp. 2–9.) A general survey of present knowledge and of some of the methods by which such knowledge has been acquired.

551.510.535 **1358**

Researches on the Ionosphere : the Work of Sir Edward Appleton.—(*Beama J.*, Dec. 1947, Vol. 54, No. 126, pp. 412–413.) A brief general account on the occasion of the 1947 Nobel Physics Prize award.

551.510.535 : 551.594.51 **1359**

Excitation Conditions in the Upper Atmosphere as determined from a Study of Atomic Emission Lines in the Auroral Spectrum.—W. Petrie. (*Canad. J. Res.*, Sept. 1947, Vol. 25, Sec. A, No. 5, pp. 293–301.) "Vegard's identifications of a number of lines appearing in the auroral spectrum are discussed. The conclusion is reached that a good many of these lines may be attributed to the oxygen atom in several stages of ionization. It is shown how measured line intensities and theoretical line strengths are combined to give the excitation temperature of the auroral region. Preliminary results indicate that this temperature is in the range 3 000° to 6 000°K. The meaning of this result is discussed briefly."

551.510.535 : 621.396.11 **1360**

Ionosphere Review : 1947.—T. W. Bennington. (*Wireless World*, Feb. 1948, Vol. 54, No. 2, pp. 44–47.) An account of the changing ionospheric conditions associated with the sunspot cycle ; the long-period changes in critical frequencies and sunspot numbers are shown to be closely correlated. Indications are that the sunspot maximum period occurred during the past year, and that November 1947 was probably the month of highest m.u.f. for long-distance radio communication in the current cycle. During the winter of 1947/1948 ionospheric transmission on frequencies of 45–50 Mc/s has frequently been possible. Maximum frequencies are expected to be slightly lower in 1948 than in 1947.

551.594.21 **1361**

On the Electric Field within and near Cumulus Clouds.—R. Lecolazet. (*C. R. Acad. Sci., Paris*, 1st Dec. 1947, Vol. 225, No. 22, pp. 1085–1086.) Records obtained during the descent of apparatus released from an aeroplane. A rapid increase of the field was found below 1 700 m and a close correlation between variations of the field and passage through cumulus clouds. Maximum values of the field were found in the middle of the clouds and minimum values underneath them. An explanation is based on differences of conductivity.

551.594.21/.22 **1362**

Progressive Lightning : Part 7 — Directly-Correlated Photographic and Electrical Studies of Lightning from Near Thunderstorms.—D. J. Malan & B. F. J. Schonland. (*Proc. roy. Soc. A*, 3rd Dec. 1947, Vol. 191, No. 1027, pp. 485–503.) " An analysis has been made of the direct correlation of luminous and electrical field-changes produced by thirty-seven lightning discharges to ground. These discharges comprised 199 separate strokes, most of which were within a distance of 6 km." For previous parts see 436 of 1939, 424, 1317, 1781, and 3133 of 1938, and back references.

LOCATION AND AIDS TO NAVIGATION

621.396.9.029.54 : 551.594.6 **1363**

Some Directional Observations of Atmospherics on 1 000 Metres during Sunset Time.—S. R. Khastgir, M. K. Das Gupta & D. K. Ganguli. (*Indian J. Phys.*, Aug. 1947, Vol. 21, No. 4, pp. 169–180.) The theory of sunrise maxima and minima in the number and strength of atmospherics due to ionospheric variations is considered. A method for locating thunderstorm centres producing atmospherics at sunrise or sunset, and results of observations with a c.r. direction finder are given.

621.396.933 **1364**

Tricon — New System for Airplane Navigation.—A. Francis. (*Tele-Tech*, Nov. 1947, Vol. 6, No. 11, pp. 38–40..99.) A new system proposed by L. Alvarez. Groups of three p.m. transmitters are used. The receiver is sensitive only to a coincidence of the three pulses. A pilot can detect aircraft within 6 miles of him, and is warned by a light and a noise if another aircraft is within 6 miles at the same height. Any ground area is divided into 60-mile by 2-mile tracks. An elevation diagram of the aircraft in each track is shown on the ground by means of lamps. Distance along a track is measured by counting accurately-spaced pulses on board the aircraft electronically. Track, distance, and altitude are indicated by the aircraft to the ground station by frequency-coded transmissions. At present the system is only in the design stage ; experimental work on it should begin shortly.

621.396.96 + 621.396.933 **1365**

Air-Line Radio.—(*Wireless World*, Jan. 1948, Vol. 54, No. 1, p. 28.) Photograph and brief description of radio equipment installed in an aircraft of British South American Airways.

621.396.96 **1366**

Technique and Development of Radar : Parts 5 & 6.—Demanche. (*Onde élect.*, Nov. & Dec. 1947, Vol. 27, Nos. 248 & 249, pp. 426–434 & 473–481.) Discusses various indicating systems. Parts 1–4, 431 of February.

621.396.96 **1367**

Radar in Peace.—W. Nowotny. (*Radio Tech., Vienna*, 1947, Vol. 23, Nos. 8/9, pp. 373–379.) A review of (*a*) the use of standard radar equipment for civil purposes, (*b*) the development of special equipment for civil use, and (*c*) navigation aids of the radar type.

621.396.96 **1368**

Airborne Radar Equipment Design.—L. H. Lynn. (*Tele-Tech*, Nov. 1947, Vol. 6, No. 11, pp. 50–54.) The AN/APS-10 light-weight assembly is described. The main components are enclosed in an air-tight container in which the pressure is maintained a little above atmospheric pressure at sea level. 3-cm pulses are radiated from a 7-kW magnetron, giving a range continuously variable from 4 to 25 nautical miles, with an additional fixed 50-mile range. The aerial assembly is stabilized gyroscopically and its angle of tilt can be varied.

621.396.96 : 621.396.615.142 : 621.396.621.54 **1369**

Reflex Oscillators for Radar Systems.—McNally & Shepherd. (*See* 1518.)

621.396.96 : 621.396.932 **1370**

Improved Marine Radar Equipment.—(*Overseas Engr*, Nov. 1947, Vol. 21, No. 241, pp. 118–120.) Description of the ' Radiolocator ' general purpose radar developed by Marconi's Wireless Telegraph Co. The transmitter and aerial are mounted as a single unit and the aerial is connected by multiple cable to the receiver. A main display unit and up to three auxiliary units may be used. The frequency range is 9 425–9 525 Mc/s ; the aerial rotates at 30 r.p.m., giving a horizontally polarized 2° beam. Side lobes are less than 7% of the main beam.

The equipment can be used almost as far as the horizon. Small fishing vessels can be detected at 7 miles range and small buoys at 1 mile. It is suggested that buoys should be fitted with corner reflectors, to make their detection easier, especially in rough seas. The central spot in the display is so small that targets can be followed to within 50 yards of the installation in calm weather. Four range scales are provided, giving maximum ranges of 1, 3, 10 and 30 nautical miles, with an accuracy on any range of better than 1% of the maximum. Total power consumption is under 5 kW.

MATERIALS AND SUBSIDIARY TECHNIQUES

533.5 **1371**

High Vacuum Pumps — Their History and Development : Part 1 — Early Types.—R. Neumann. (*Electronic Engng*, Jan. 1948, Vol. 20, No. 239, pp. 3–8.)

535.37 **1372**

Peculiar Properties of New Alkaline Earth Phosphors, sensitive to Infra-Red Rays.—V. V. Antonov-Romanovski. (*C. R. Acad. Sci. U.R.S.S.*, 11th Nov. 1947, Vol. 58, No. 5, pp. 771–774. In Russian.) It was suggested by the author in 1943 that ultra-violet light not only excites alkaline earth phosphors but also accelerates the appearance of scintillation. This accelerating effect is discussed. The relative values of the light sum for excitation by light and by heat are considered.

535.37 **1373**

The Luminescence of Crystalline Phosphors under Constant Excitation in the Region of the Fundamental Absorption Bands.—E. I. Adirovich. (*C. R. Acad. Sci. U.R.S.S.*, 1st July 1947, Vol. 57, No. 1, pp. 25–28. In Russian.)

535.37 **1374**

Temperature Extinction of Photoluminescence of Zinc Oxide.—F. I. Vergunas & F. F. Gavrilov. (*C. R. Acad. Sci. U.R.S.S.*, 1st July 1947, Vol. 57, No. 1, pp. 31–34. In Russian.) Experimental results show that a formula of the type given by Gurney & Mott (*Trans. Faraday Soc.*, 1939, Vol. 35, Part 1, pp. 69–73) for the number of quanta emitted per quantum absorbed is applicable to ZnO.

535.371 : 546.711 **1375**

A Spectroscopic Evidence for Activation of Fluorescence by High Valency Manganese Ions.—G. Szigeti, E. Nagy & E. Makai. (*J. chem. Phys.*, Dec. 1947, Vol. 15, No. 12, pp. 881–882.) The emission spectrum curve for Mn-activated $ZnBeSiO_3$ phosphors is the same curve as that for the extinction coefficient of K_2MnO_4 in a strong alkaline solution. The fluorescence emission centres are probably associated with the $(MnO_4)^{--}$ and $(MnO_4)^{-}$ ions embedded in the silicate lattice.

537.311.3 : 621.383 **1376**

Conductivity of Evaporated Films of Lead Selenide.—O. Simpson. (*Nature, Lond.*, 6th Dec. 1947, Vol. 160, No. 4075, pp. 791–792.) Films of thickness 0.5 μ on pyrex are found to be extremely sensitive to oxygen, a pressure of 10^{-4} to 10^{-5} mm Hg being sufficient to cause the resistance to increase by a factor of 10 or more. A theoretical explanation of the observed effects is given.

546.287 + 621.315.61 **1377**

Silicone Insulation Board.—(*Elect. Times*, 1st Jan. 1948, Vol. 113, No. 2930, p. 13.) Small quantities of this material are now obtainable. It is capable of continuous operation at 250°C, has low loss even at this temperature and has high mechanical and breakdown strength.

621.3(54) **1378**

Electrical Engineering Problems in the Tropics : Part 1.—R. Allan. (*Beama J.*, Dec. 1947, Vol. 54, No. 126, pp. 442–447.) Long summary of I.E.E. paper. A discussion of operating conditions for electrical equipment in India. The effects of unskilled labour, high temperature, strong sunlight, and high relative humidity are considered. In particular, at temperatures around 90°C, fibrous insulating materials can disintegrate, causing mechanical failure, and with the relative humidity at about 90% at these temperatures, good insulators may become poor conductors, causing electrical failure. To be concluded.

621.314.634 **1379**

On Selenium Rectifiers.—T. I. Moldaver. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, 1941, Vol. 5, Nos. 4/5, pp. 457–466. In Russian with English summary.) An experimental investigation was carried out with selenium rectifiers prepared by condensing selenium vapour in vacuo. The preparation of the rectifiers is described in detail and the use of Fe, Ni, Al, Cd, Cu and Zn for contact electrodes is discussed. The use of Cd, Zn, Pb, Sn, Au and various alloys for the preparation of emission cathodes was also investigated. A theoretical discussion of the results is given and Meyer's theory of the barrier layer is contradicted.

621.315.59 + 537.311.33 **1380**

Excess-Defect Germanium Contacts.—S. Benzer. (*Phys. Rev.*, 15th Dec. 1947, Vol. 72, No. 12, pp. 1267–1268.) As forecast by Sosnowski (443 of February) rectification and photoelectric effects have been found in Ge-crystal/metal-point contacts. At higher voltages and with constant illumination, marked saturation occurs in the conducting direction. A linear photosensitivity of several milliamperes per lumen of white light is obtained and varies little with voltage and temperature. Negative-resistance and self-oscillation effects are mentioned.

621.315.59 **1381**

Electrical Resistance of the Contact between a Semi-Conductor and a Metal.—A. V. Joffe. (*J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 1, pp. 49–60.) Measurements of contact potential showed its independence of temperature and the specific conductivity of the specimen. The dependence of the resistance near the electrodes on the potential difference, temperature and current direction was investigated ; rectification was feebly present.

621.315.61.011.5 : 546.431.823 : 536.48 **1382**

Dielectric Constant of Barium Titanate at Low Temperatures.—B. Wul. (*J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 1, pp. 64–66.) At 4.2°K, $\epsilon = 100$, and the temperature coefficient for 2–4.2°K is 0.005–0.006 deg.$^{-1}$.

621.315.614 : 533.5 **1383**

Vacuum Drying of Paper.—N. M. Foote. (*Industr. Engng Chem.*, Dec. 1947, Vol. 39, No. 12, pp. 1642–1646.) " The sorption of water by kraft paper and the decomposition of the paper were studied under conditions comparable to those present in impregnation processes. Decomposition accompanies severe drying and at high temperatures supplants the final drying." The mechanism of these processes is not fully understood.

621.315.614 : 621.319.4 **1384**

A New Kraft Capacitor Paper.—H. F. Miller & R. J. Hopkins. (*Gen. elect. Rev.*, Dec. 1947, Vol. 50, No. 12, pp. 20–24.) Discussion of modifications of the treatment of wood pulp required to improve the electrical properties of capacitor paper. The new process halves production costs, permits operation at higher temperatures and simplifies the design of capacitor housings. Paper thickness can be as low as 0.000 2 inch and power factor at 100°C is lower than that obtained when linen pulp is used. A 25-kVA capacitor can now be designed for voltage ratings of upwards of 2 400 V.

621.315.616 **1385**

Organic H.F. Insulating Materials and Their Chemical Structure.—W. M. H. Schulze. (*Funk u. Ton*, Dec. 1947, No. 6, pp. 295–305.) Study of old and new synthetic insulating materials shows the intimate relation between their molecular structure and dielectric properties. Further research should result in the discovery of a whole series of dipole-free materials with low dielectric constant and loss angle, suitable for h.f. insulation.

621.315.62 + 621.317.2 **1386**

H.F. Insulators for High Transmitting Power.—W. Hüter. (*Funk u. Ton*, Dec. 1947, No. 6 & Jan. 1948, No. 1, pp. 281–294 & 8–16.) Low dielectric loss is essential for the ceramic insulators normally used and overvoltage tests at the operating frequency are necessary. Glow and brush discharges from aerial wires, insulator terminals, tuning coils or capacitors, can usually be avoided by suitable metallizing and by rounding off all sharp corners. A high-voltage laboratory with high-power test generators for wavelengths of 2 000 m and 600 m is described.

621.316.54.004.5 **1387**

Cleaning Switch Contacts.—J. J. Payne. (*Wireless World*, Feb. 1948, Vol. 54, No. 2, pp. 51–52.) The use of carbon tetrachloride, which removes grease as well as dirt, leads to excessive wear of the contacts. A better cleaning solution is 10% lanolin in white spirit or trichlorethylene, which removes dirt but after evaporation leaves a film of grease on the contact surfaces.

621.383 : 535.215.1 : 546.682 **1388**

The Photoelectric Properties of Sulphides and Selenides of Indium.—B. T. Kilomiets & S. M. Ryvkin. (*Zh. tekh. Fiz.*, 1947, Vol. 17, No. 9, pp. 987–992. In Russian.) Investigation of the photoconductive effects of treating layers of InS with sulphur vapour and of treating layers of InSe with selenium vapour. Several experimental curves are plotted and discussed.

621.396.611.21 : 549.514.51 **1389**

Measurement of Equivalent Parameters of Quartz Crystals by an Oscillation Method.—B. K. Shembel. (*Zh. tekh. Fiz.*, 1947, Vol. 17, No. 3, pp. 349–364. In Russian.) With the rapidly expanding production of quartz crystals, methods for quickly checking their properties are urgently required. The properties can be investigated either by testing the crystals in the circuits for which they are intended or by measuring parameters which would give an indication of the properties of the finished product. A simple method of the latter type is described which uses auto-oscillations of the crystal in a valve oscillator circuit and differs from the direct and resonant methods based respectively on freely damped and forced oscillations. A suitable oscillatory circuit (Fig. 3) is suggested and various methods are proposed for measuring the equivalent resistance and inductance of the crystal. These tests can be carried out over the whole frequency range of quartz crystals. Special testing apparatus which does not require powerful high-stability oscillators and can be used by comparatively unskilled personnel is also briefly discussed.

628.971.6 : 621.327.43 **1390**

Fluorescent Light and Lamps.—J. L. Salpeter. (*Philips tech. Commun., Aust.*, April 1946, No. 2, pp. 2–12.) Physical principles and applications.

666 + 621.315.612 **1391**

Properties and Uses of Technical Ceramics.—H. Thurnauer. (*Materials & Methods*, Dec. 1947, Vol. 26, No. 6, pp. 87–92.) Discusses physical and electrical properties and tabulates data for typical materials.

MATHEMATICS

517.941.9 : 53 **1392**

The Method of the Hypercircle in Function-Space for Boundary-Value Problems.—J. L. Synge. (*Proc. roy. Soc. A*, 3rd Dec. 1947, Vol. 191, No. 1027, pp. 447–467.) "The method has been applied to problems of the Dirichlet and Neumann types in Riemannian N-space and to elastostatic boundary value problems." The method is also applied to membrane and e.m. vibration problems. See also 2479 of 1947 (Grünberg).

518.5 : 621.392.5 **1393**

The Miller Integrator and Its Derivatives.—(*See* 1297.)

501 **1394**

Applied Mathematics for Engineers and Physicists. [Book Review]—L. A. Pipes. McGraw-Hill, London, 1946, 618 pp., 27s. 6d. (*Beama J.*, Dec. 1947, Vol. 54, No. 126, pp. 422–423.) Matrix algebra and the operational calculus are extensively used. The book is suitable "mostly for senior physicists and engineers with advanced mathematical proclivities, but it is also valuable as a practical guide for postgraduate workers. Without question the book is one of the best on applied mathematics which have appeared within recent years."

512.831 + 512.9 **1395**

Matrix and Tensor Calculus. [Book Review]—A. D. Machal. John Wiley & Sons, New York, 132 pp., $3.00. (*J. Franklin Inst.*, Nov. 1947, Vol. 244, No. 5, p. 412.) "The work is a well connected logical progression of interest to engineers generally who have need of this type of mathematics and especially to aeronautical engineers."

517.564.3(083.5) **1396**

Tables of the Bessel Functions of the First Kind. [Book Review]—Harvard University Press, Cambridge, Mass., & Oxford University Press, London, 1947, 55s. each volume. (*Nature, Lond.*, 6th Dec. 1947, Vol. 160, No. 4075, pp. 773–774.) Vols. 3–6 of the tables compiled by the staff of the Computation Laboratory, Harvard, and giving functions of the first kind of orders 1 to 9. They contain values of $J_n(x)$ for $x = 0(0.001)25(0.01)99.99$. The values for $n = 0, 1, 2, 3$ are given to 18 places of decimals, while those for the higher values of n are given to 10 places. "Photographic reproduction from typescript, as used in these and other tables, has disadvantages which go some way to offset its evident advantages." For notice of Vols. 3 & 4, see 463 of February.

517.942.93 **1397**

Theory and Applications of Mathieu Functions. [Book Review]—N. W. McLachlan. Oxford University Press, New York, 1947, 400 pp., $12.50. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1947, Vol. 35, No. 12, p. 1528.) "A comprehensive reference on a useful subject" for the physicist and engineer.

MEASUREMENTS AND TEST GEAR

621.317.081.3 + 53.081.3 **1398**

Resolutions of the International Committee for Weights and Measures.—Götz. (*Elektrotech. u. Maschinenb.*, Nov./Dec. 1947, Vol. 64, Nos. 11/12, pp. 189–193.) Full text of the resolutions on changes in the electrical units. See also 2833 of 1947.

621.317.2 + 621.315.62 **1399**

H.F. Insulators for High Transmitting Power.—Hüter. (*See* 1386.)

621.317.3.029.63/.64 : 621.396.67 **1400**

An Automatic Polar Diagram Recorder.—A. H. Beck & S. A. Tibbs. (*Electronic Engng*, Jan. 1948, Vol. 20, No. 239, pp. 17–19.) A rapid and convenient method of plotting an independent variable against a dependent variable which can be converted into a rotation. Developed primarily to test 3-cm radar aerials whose beam widths were of the order of 1°, it records a complete polar diagram in 2 sec. The record is made on Teledeltos recording paper which is drawn past a stylus by rollers geared by means of selsyns to the aerial shaft. The aerial is connected to a microwave superheterodyne receiver consisting of crystal mixer, 30-Mc/s i.f. amplifier, diode second detector and long-tailed-pair d.c. amplifier designed to work into the 5 000-Ω impedance of the recorder coil actuating the stylus. See also 1914 of 1946 and 1130 of 1947 (Clayton et al.).

621.317.32 : 621.396.712.2 **1401**

The Measurement of Circuit Voltages in a Studio Installation.—de Fremery & Wenke. (*See* 1500.)

621.317.333.82 **1402**

The Henley 1 200 000 Volt Impulse Testing Plant. Part 4 — The Complete Impulse Plant.—T. R. P. Harrison. (*Distrib. Elect.*, Jan. 1948, Vol. 20, No. 169, pp. 303–306.) Discussion of its operation, with typical records from cable tests. Parts 1–3, 2848 of 1947 and 469 of February.

621.317.35.029.4 **1403**

L.F. Analyser.—F. Haas. (*Toute la Radio*, Dec. 1947, Vol. 14, No. 121, pp. 5–7.) An instrument combining a l.f. oscillator with variable output voltage, a calibrated attenuator and a simplified oscilloscope. The c.r. tube used may be either Mazda C30S, Philips DG3-1 or 913 RCA. Detailed circuit diagrams are given.

621.317.36 : 621.396.619.13 **1404**

Measurement of the Deviation Ratio in F.M.—G. V. Dlugach & I. M. Sorkin. (*Radiotekhnika, Moscow*, 1947, No. 7, pp. 25–40. In Russian.) Various methods are surveyed and formulae derived for determining errors when a frequency meter or an oscilloscope is used. The frequency detector method is also discussed. A detector similar to that proposed by Summerhayes (595 of 1943) is briefly described.

621.317.361 : 621.396.611.21 **1405**

Frequency Calibration of Quartz Crystals.—L. F. Koerner. (*Bell Lab. Rec.*, Nov. 1947, Vol. 25, No. 11, pp. 418–421.) The crystal frequency is fed to one grid of a detector tube and a standard frequency to the other. The audio difference frequency is given by a calibrated frequency meter and the crystal can be quickly adjusted to oscillate at the standard frequency. By this method 500 crystals can be adjusted by one operator in a day.

621.317.6 : 621.396.97 **1406**

Audio Frequency-Response Measurements in Broadcasting.—A. E. Richmond. (*Audio Engng, N.Y.*, Jan. 1948, Vol. 32, No. 1, pp. 21–24..46.) Discussion of technique using a transmission measuring set.

621.317.66 : 621.314.2.029.3 **1407**

Output Transformer Efficiency.—A. E. Falkus. (*Wireless World*, Jan. 1948, Vol. 54, No. 1, pp. 26–27.) A method of determining the power supplied to an audio output transformer, and its efficiency. The primary is tuned with a variable capacitance adjusted so that input current and voltage are in phase. The leakage inductance can be determined from the value of the variable capacitance.

621.317.7 **1408**

Measurements at Very High Frequencies.—D. B. Sinclair. (*Tecn. elettronica*, Sept. & Oct. 1947, Vol. 2, Nos. 3 & 4, pp. 219–232 & 317–332. In Italian.) Fundamental principles, and discussion of valve voltmeters, crystal voltmeters, oscillators, standard signal generators and wavemeters.

621.317.714.025.434.029.6 : 621.362 **1409**

Experiments with Thermocouple Milliammeters at Very High Radio Frequencies.—G. F. Gainsborough. (*J. Instn elect. Engrs*, Part III, Nov. 1947, Vol. 94, No. 32, pp. 427–428.) Discussion on 1114 of 1945.

621.317.733 **1410**

A New Technique in Bridge Measurements.—R. Calvert. (*Electronic Engng*, Jan. 1948, Vol. 20, No. 239, pp. 28–29.) An admittance bridge suitable for high frequencies may be designed by substituting a tapped transformer winding for the orthodox ratio arms. If the leakage inductance of the winding is sufficiently small, low-impedance arms can be produced such that heavy capacitive loads have virtually no effect upon their voltage ratio. Multi-ratio direct-reading bridges covering the ranges required for aerial, h.f. cable and transmission-line work on frequencies up to 50 Mc/s have been developed and are commercially available. Experiments show that extension to 200 Mc/s may be practicable. The basic circuit of such bridges is analysed. The effects of stray capacitance and residual leakage inductance, and possible corrective measures, are discussed.

621.317.755 **1411**

Cathode Ray Oscillograph Recording Systems: Part 2.—(*Electronic Industr.*, Nov. 1947, Vol. 1, No. 11, pp. 6–7.) Systems for doubly-timed sweeps, including radar displays, superimposed patterns, scanning, spiral timebases and double displaced timing. Part 1, 770 of March. Part 3, 1412 below.

621.317.755 **1412**

Cathode Ray Oscillograph Recording Systems: Part 3.—(*Electronic Industr.*, Jan. 1948, Vol. 2, No. 1, pp. 8–9.) Sweep circuits for linear and rotary displacements, velocity-controlled sweeps and circuits for (x, y) recording and for magnetic testing. Part 2, 1411 above.

621.317.79 : 621.396.615 **1413**

Improved Wide-Band Wobbulator.—Smith. (*See* 1310.)

621.317.79 : 621.396.615 **1414**

Variable A.F. Portable Oscillator.—A. R. A. Rendall & F. A. Peachey. (*Wireless Engr*, Feb. 1948, Vol. 25, No. 293, pp. 37–43.) The oscillator was designed for testing inter-station lines used for broadcasting. The frequency ranges covered are 20–200, 200–2 000 and 2 000–20 000 c/s. Output is 100 mW with an output impedance of 600 Ω ± 3% over the whole frequency range. The frequency is accurate to 1% or 1 c/s whichever is the greater. The output is constant to ± 0.25 db and the waveform is suitable for measuring amplitude distortion where the unwanted products are about 1%.

The resistance/temperature characteristic of a lamp is used to obtain the required negative feedback. A novel feature is provided by an increment switch whereby the frequency can be changed by ± 0.4 c/s or ± 0.2 c/s on the lowest range and by suitable fractions on the other ranges. See also 2644 of 1946 (Peachey, Berry & Gunn-Russell).

621.317.79 : 621.396.615 : 621.397.62.001.41 **1415**

Generator for Alignment of Television Receiver Circuits.—M. Lecointe. (*Télévis. franç.*, Dec. 1947, No. 32, pp. 9–13, 17.) Apparatus comprising (*a*) tuned-grid oscillator, (*b*) l.f. valve which passes on the modulation voltages applied to the input terminals, (*c*) mixing valve for modulation of the h.f. voltages, (*d*) two triodes used as grid detectors and serving as valve voltmeters for measurement of the injected modulation voltages and of the resulting h.f. voltages.

621.317.79 : 621.396.615.12 **1416**

New Compact Signal Generator has Laboratory Features.—G. Dexter. (*Radio News*, Dec. 1947, Vol. 38, No. 6, pp. 58–59 . . 120.) Frequency range is 90 kc/s–210 Mc/s. The apparatus can be used for a.m., f.m. and television receivers. Circuit diagram and component details are given.

621.317.791 : 621.392.029.64 **1417**

Simple Measuring Equipment for Flexible Waveguides.—A. M. Winchell. (*CQ*, Nov. 1947, Vol. 3, No. 11, pp. 28–31 . . 99.) Microwave test gear for frequency measurement, impedance matching, etc., discussed from the point of view of a radio amateur whose previous experience has been at lower frequencies.

621.396.615.17 : 621.396.822 : 621.396.621.001.4 **1418**

Impulse Noise Generator for Testing F.M. Receivers.—J. C. Tellier. (*Tele-Tech*, Nov. 1947, Vol. 6, No. 11, pp. 28–30 . . 98.) Impulse noise input to a f.m. receiver causes shock excitation of the i.f. system, which rings at its natural centre frequency. Whether or not this ringing produces output from the second detector of the receiver depends upon the relative phase angle of the desired signal and the noise burst.

An external generator is here discussed, designed to simulate the desired signal and also to provide a noise burst having any degree of phase shift relative to the signal. Complete construction details are given. For the theory of impulse noise in f.m. receivers see 857 of 1947 (Smith & Bradley).

621.396.621.001.4 **1419**

Measurements of F.M. Receivers.—J. Minter. (*Proc. Radio Cl. Amer.*, Jan. 1947, Vol. 24, No. 1, pp. 6–7.) An outline of standard R.M.A. test methods for f.m. receivers, described fully in R.M.A. publication DB-2170-A: "The Measurement of Performance Characteristics of Frequency Modulated Radio Receivers."

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

531.719 : 621.317.73 **1420**

Development and Application of the Electric Expansion Meter for the Measurement of Static and Dynamic Stresses.—A. R. Anderson. (*Schweiz. Arch. angew. Wiss. Tech.*, Nov. 1947, Vol. 13, No. 11, pp. 321–334. Discussion, pp. 334–336.) A flat coil of very fine elastic resistance wire is cemented to the test-piece, whose expansion is determined from the resistance variation of the coil due to stretching. Many different applications are described. Dynamic effects are displayed on a c.r.o.

534.321.9.001.8 **1421**

Testing by Ultrasonics.—S. Y. White. (*Audio Engng, N.Y.*, Nov. 1947, Vol. 31, No. 10, pp. 28–30 . . 40.) Three fundamental test methods are described: by reflection, by velocity, and by attenuation of the signal. Applications to determination of depth, submarine detection, oil prospecting, mineral exploration, flaw detection, temperature measurement and thorough mixing of gases and liquids are discussed.

536.5.087.4 : 621.317.727 **1422**

R.F. Oscillator Controlled Potentiometer Recorder.—P. Semm & R. P. Nakasone. (*Electronic Industr.*, Jan. 1948, Vol. 2, No. 1, pp. 6–7, 21.) For recording temperature variations. The fundamental measuring device is a short swing galvanometer on whose pointer is mounted a small aluminium flag. This flag moves between two coaxially mounted pancake coils, and alters the frequency of a 15-Mc/s oscillator. The frequency deviation is used to drive a slide-wire contact to restore bridge balance. A feedback method of reducing hunting is described. Accuracy claimed is 0.1% of full scale range.

539.16.08 **1423**

Photon and Particle Counters.—A. Givelet. (*Télévis. franç.*, Nov. 1947, No. 31, Supplement *Électronique*, pp. 35–39.) A general account, with construction and working details and suggested applications.

539.16.08 **1424**

Resolving Power of Selfquenching Counter Tubes for High Counting Rates.—E. Baldinger & P. Huber. (*Helv. phys. Acta*, 31st Dec. 1947, Vol. 20, No. 6, pp. 470–475. In German.) With constant applied voltage the dead-time depends on the pulse height. Stever's method (1859 of 1942) was used to measure this dependence. From the results the misses for high counting rates can be calculated. Measurements were also made of the dead-time for different filling gases.

539.16.08 **1425**

Reduction of 'Insensitive Time' in Geiger-Müller Counters.—A. L. Hodson. (*J. sci. Instrum.*, Jan. 1948, Vol. 25, No. 1, pp. 11–13.) "A simple 'flip-flop' circuit has been used to reverse the voltage of a Geiger counter after each discharge, in order to reduce the insensitive time of the counter by collecting the positive ions on the wire. The new insensitive time is of the order of 3×10^{-5} sec. The circuit has been tested by measuring the inefficiency of a counter with a new, fast hard-valve anti-coincidence circuit."

620.179.16 **1426**

Electronic Metalloscopes.—V. Parenti. (*Tecn. elettronica*, Oct. 1947, Vol. 2, No. 4, pp. 353–365. In Italian.) An account of ultrasonic methods of detecting cracks and flaws in metals, together with a detailed description of the Mark IIB detector, made by Henry Hughes & Son, London.

621.317.083.7 : 551.51 : 623.419 **1427**

High Altitude Research with V-2 Rockets.—E. H. Krause. (*Proc. Amer. phil. Soc.*, 3rd Dec. 1947, Vol. 91, No. 5, pp. 430–446.) A brief account of the equipment used, and of experiments carried out during the first year of an American investigation. The rocket can carry about 2 000 lb of instruments to a height of about 150 km and during each flight spends 5 min above a height of 50 km. Data acquired during the flight can be recorded directly. Records and instruments have a fair chance of surviving the impact on landing. Alternatively, the data may be communicated to the ground by a small 1 000-Mc/s transmitter with a peak power of 1–2 kW. A 23-channel pulse-time-modulation system is used for conveying information and each channel is sampled 200 times per second. The present programme is concerned with air pressure, temperature and composition, cosmic rays, the ionosphere, and astrophysics involving primarily the spectrum of the sun. See also 94, 3512 and 3882 of 1947.

621.365 **1428**

A Compact 6-kW Radio Frequency Heater.—(*Engineer, Lond.*, 5th Dec. 1947, Vol. 184, No. 4793, p. 537.) Brief details are given of equipment manufactured by Messrs Pye Ltd, giving a 6-kW 10-Mc/s output continuously variable from half to full power. A single silica valve is used as a self-excited oscillator. The equipment is self-contained, operates from a 3-phase 50-c/s supply and consumes 10.5 kW on full load.

621.365.5 + 621.365.92 **1429**

Industrial Applications of R.F. Heating.—(*Overseas Engr*, Dec. 1947, Vol. 21, No. 242, pp. 172–173.) New equipment for heating metallic and non-metallic substances.

621.38.001.8 : 771.448.1 **1430**

Electronic Photoflash Unit.—W. G. Many. (*Radio News*, Dec. 1947, Vol. 38, No. 6, pp. 44–45.) Circuit diagram and construction details for a semi-portable unit which may be operated manually or synchronized with the camera shutter.

621.384 : 621.396.611.4 **1431**

Acceleration of Electrons by a Resonant Cavity.—F. L. Hereford, Jr. (*J. appl. Phys.*, Nov. 1947, Vol. 18, No. 11, pp. 956–960.) Electrons were accelerated by means of a single resonant cavity operating at λ 75 cm. Energies as high as 0.75 MeV were attained by single-stage acceleration, the electrons entering the cavity virtually at zero velocity. By turning the emergent beam about and reinjecting it into the cavity in the opposite direction, 2-stage acceleration was achieved and 1.25-MeV electrons were produced. Possibilities of a 'shuttle accelerator' are discussed.

621.384.6 **1432**

Design of an Air Core Synchrotron.—J. P. Blewett. (*J. appl. Phys.*, Nov. 1947, Vol. 18, No. 11, pp. 976–982.) The theory developed in 1350 above is used to design a synchrotron in which the magnetic fields are produced by air core coils.

621.385.833 **1433**

Introduction to the Electron Microscope.—(*Tecn. elettronica*, Oct. 1947, Vol. 2, No. 4, pp. 367–371. In Italian.) An elementary survey.

621.385.833 **1434**

On a Source of Electrons for Electron Microscopes.—G. Induni. (*Helv. phys. Acta*, 31st Dec. 1947, Vol. 20, No. 6, pp. 463–467. In French.) Summary of Swiss Phys. Soc. paper. Description of a cold-cathode source giving a beam with very uniform electron velocities. The source can be used with an accelerating potential of 50 kV.

621.385.833 **1435**

The Use of Diaphragms in the Electron Microscope.—S. G. Ellis. (*Canad. J. Res.*, Nov. 1947, Vol. 25, Sec. A, No. 6, pp. 322–337.) A method is described for deducing electron trajectories from optical measurements made on the electron microscope. A device for centering and changing apertures while the microscope is in operation is described. The choice of the size and position for diaphragms is discussed, together with other factors involved in their use.

621.385.833 : 621.317.729 **1436**

Design of Electron Lenses.—R. G. E. Hutter. (*Tele-Tech*, Nov. 1947, Vol. 6, No. 11, p. 55.) The study of electron paths through electron lenses and prisms is facilitated by immersing scale models in a tank containing a low-conductivity electrolyte such as water. Equipotential lines are determined by means of probes, using a valve voltmeter as indicator.

PROPAGATION OF WAVES

538.566 + 535.42/.43 **1437**

Notes on Diffraction Phenomena.—Duffieux. (*See* 1342.)

538.566 + 621.396.11 **1438**

Accurate Measurement of the Group Velocity of Radio Waves in the Atmosphere, using Radar Technique.—R. A. Smith, E. Franklin & F. B. Whiting. (*J. Instn elect. Engrs*, Part III, Nov. 1947, Vol. 94, No. 32, pp. 391–395. Discussion, pp. 402–406.) The time of travel of pulses between two ground stations is accurately determined in terms of calibration marks generated by an accurate crystal, account being taken of the measured delays in the receiving equipment. The mean value obtained for the velocity of propagation in the atmosphere at ground level is 299 695 ± 50 km/sec. This value does not differ significantly from that calculated from the best optical values for the velocity of light in free space, allowing for the refractive index of the atmosphere.

538.566 + 621.396.11 + 538.32 **1439**

The Field of a Plane Wave near the Surface of a Conductor.—Fock. (*See* 1351.)

538.566 + 621.396.11 **1440**

A Method of determining the Velocity of Radio Waves over Land on Frequencies near 100 kc/s.—E. B. Mendoza. (*J. Instn elect. Engrs*, Part III, Nov. 1947, Vol. 94, No. 32, pp. 396–398. Discussion, pp. 402–406.) The method is based on the Decca hyperbolic navigation aid system. The velocity was determined from measurements of phase in an aircraft at a point on the extension of the line joining two Decca transmitters in Belgium, knowing the radio frequency and the distance between the stations. Tests were made for dispersion, but they were negative. The average velocity was $2.9925 \pm 0.0004 \times 10^8$ m/s; the method gives phase velocity. The low value is not inconsistent with theory.

538.566 + 621.396.11.029.64 **1441**

The Measurement of the Velocity of Propagation of Centimetre Radio Waves as a Function of Height above the Earth : Part 1 — Ground-Level Measurements of the Velocity of Propagation over a Sea Path.—F. E. Jones. (*J. Instn elect. Engrs*, Part III, Nov. 1947, Vol. 94, No. 32, pp. 399–401. Discussion, pp. 402–406.) The radar range between accurately surveyed sites 400 ft above sea level was measured by means of a 9-cm Oboe blind-bombing system. The preparatory measurements made to assess the accuracy of the final result are discussed. All display traces were photographically recorded. The final value for the velocity is 299 687 ± 25 km/sec.

538.566 + 621.396.11] : 551.510.535 **1442**

On the Propagation of E.M. Waves through the Upper Atmosphere.—M. N. Saha, B. K. Banerjea & U. C. Guha. (*Indian J. Phys.*, Aug. 1947, Vol. 21, No. 4, pp. 181–198.) A mathematical treatment taking into account the earth's magnetic field and treating the e.m. properties of the medium as tensor quantities. The equations for vertical propagation are obtained. Expressions are derived for the refractive indices of ordinary and extraordinary waves and for the polarization and absorption of waves travelling in the ionosphere. Curves are given for the polarization ratio and refractive indices of the two waves as functions of the magnetic latitude of the place of observation. See also 3620 of 1947 (Banerjea).

538.566 : 621.396.11 **1443**

The Field of a Microwave Dipole Antenna in the Vicinity of the Horizon : Part 2.—C. L. Pekeris. (*J. appl. Phys.*, Nov. 1947, Vol. 18, No. 11, pp. 1025–1027.) Extension of 224 of January to two further cases (*a*) when the heights of the transmitter and receiver are both less than unity (in natural units), but not zero, and (*b*) when the height of the transmitter is greater than unity while that of the receiver is less than unity. The results are in reasonable agreement with those of van der Pol & Bremmer (2249 of 1939).

621.396.11 **1444**

Solution of the Problem of Propagation of Electromagnetic Waves along the Earth's Surface by the Method of Parabolic Equation.—M. Leontovitch & V. Fock. (*J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 1, pp. 13–24.) English translation of 1901 of 1947.

621.396.11 : 551.510.535 **1445**

Ionosphere Review : 1947.—Bennington. (*See* 1360.)

621.396.11 : 551.510.535 **1446**

Long-Distance Radio Transmission.—R. Lentini. (*Tecn. elettronica*, Sept. 1947, Vol. 2, No. 3, pp. 285–288. In Italian.) A brief account of propagation conditions and m.u.f. predictions, emphasizing their interest and importance to the amateur.

621.396.11 : 551.510.535 : 523.745 **1447**

Sunspots and Very-High-Frequency Radio Transmission.—K. A. Norton. (*QST*, Dec. 1947, Vol. 31, No. 12, pp. 13–17 . . 112.) Discussion of the present high solar activity and m.u.f. forecasts shows that conditions this winter are favourable for east-to-west transmission across the U.S.A., using low power in the 50–54-Mc/s amateur band.

621.396.11.029.4 **1448**

Propagation of Long Waves round the Earth.—O. Zinke. (*Frequenz*, Oct. 1947, Vol. 1, No. 1, pp. 16–22.) An expression for the field strength of very long waves is derived, valid for great distances up to about 20 000 km. This new formula differs in three respects from Austin's formula, (*a*) in dependence of field strength on distance, (*b*) in the effect of wavelength on attenuation, and (*c*) with regard to interference at the antipole of the transmitter. At great distances from the transmitter it gives higher field strengths than Austin's formula and agrees better with experimental results.

621.396.11.029.58 **1449**

Operating Characteristics of the 21-Mc/s Band.—O. P. Ferrell. (*CQ*, Nov. 1947, Vol. 3, No. 11, pp. 20–23.) Propagation characteristics are compared for the 10-m, 14-m and 20-m amateur bands. A polar graph is given of azimuth and skip distance for New York at various times of day for November 1947, and the use of C.R.P.L. D-series predictions for this type of calculation is discussed. The calculation of average field strength for New York/Los Angeles transmission is also considered for November 1947 and for the next sunspot minimum in January 1953.

621.396.11.029.62 **1450**

U.S.W. Propagation.—P. G. Violet. (*Funk u. Ton*, 1947, Nos. 2 & 4, pp. 100–105 & 206–212.) A general review of the various theories and of experimental results for short-range (< 10 km), medium-range (10–200 km) and long-range (> 200 km) propagation in the frequency band 30–300 Mc/s.

621.396.11.029.62 **1451**

Any DX Today ?—D. W. Heightman. (*QST*, Jan. 1948, Vol. 32, No. 1, pp. 25–31, 130.) Discussion of ionospheric propagation on frequencies near 50 Mc/s, with special reference to the factors affecting the m.u.f.

621.396.81.029.58 **1452**

More Low-Power Transmission.—W. Oliver. (*Wireless World*, Jan. 1948, Vol. 54, No. 1, pp. 25–26.) Results obtained in a 5-month period of 1947 at G3XT with an input of 1 W are compared with corresponding pre-war results (4287 of 1939). The 1947 equipment is briefly described. Results for alternative 3-W and 5-W transmitters were very similar to those for the 1-W transmitter.

621.396.812.4.029.62 **1453**

A Study of Tropospheric Reception at 42.8 Mc/s and Meteorological Conditions.—G. W. Pickard & H. T. Stetson. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1947, Vol. 35, No. 12, pp. 1445–1450.) Field strength measurements continuously recorded at a station 167 miles distant and approximately 7 miles below the line of sight from the transmitter are correlated with meteorological conditions. Analysis of results shows that propagation is entirely tropospheric. Conditions favourable to transmission are: summer, high surface refraction, rising temperatures, low wind velocities, winds parallel to the path and no frontal passages. Summary noted in 3634 of 1947.

621.396.82 + 621.396.11 **1454**

Radio Propagation in the Frequency Range 40–100 Mc/s.—Bennington. (*See* 1478.)

RECEPTION

621.396.61/.62].029.63 **1455**

Four-Twenty is Fun!—Tilton. (*See* 1509.)

621.396.619.11/.14 **1456**

Better N.F.M. Reception with A.M. Receivers.—E. Harrington & W. Bartell. (*QST*, Nov. 1947, Vol. 31, No. 11, pp. 38–41..126.) Construction details of a simple and inexpensive narrow-band f.m. adapter for use with a.m. receivers having an i.f. of about 456 kc/s. A squelch circuit is used to suppress noise when the carrier is off.

621.396.62 **1457**

Tendencies in the Design of the Communication Type of Receiver.—G. L. Grisdale & R. B. Armstrong. (*J. Instn elect. Engrs*, Part III, Nov. 1947, Vol. 94, No. 32, pp. 418–420.) Discussion on 223 of 1947.

621.396.621 + 621.396.69 + 621.385.1 **1458**

Miniatures in Radio.—Slišković. (*See* 1339.)

621.396.621 **1459**

Receiver Design.—L. Ratheiser. (*Radio Tech., Vienna*, 1947, Vol. 23, No. 10, pp. 475–480.) Discusses simple means of obtaining increased sensitivity, increase of output with parallel connection of end-stage valves, practical limit of sensitivity increase by increase of l.f. amplification, various circuits for l.f. stages, coil design, coupling and screening.

621.396.621 **1460**

On Amplitude Selectivity.—Ya. I. Efrussi. (*Radiotekhnika, Moscow*, 1947, No. 7, pp. 41–56. In Russian.) Certain nonlinear systems used as amplitude limiters do not respond to the input voltage until the latter exceeds a certain minimum value; above this value the output of the system increases linearly with the input (Fig. 2). Such a system could be used for amplifying a weak signal with a background of a stronger signal of the same frequency, since the weak signal would be, as it were, carried on the crests of the waves of the stronger signal. The author calls the system an 'amplitude filter' and gives a theory of its operation. Suitable circuits are proposed and methods for designing these are discussed. Results of experiments are given and possible uses of the filter indicated.

621.396.621 **1461**

The Reproduction of High and Low Tones in Radio Receiving Sets.—V. C. Hendriquez. (*Philips tech. Commun., Aust.*, Dec. 1946, No. 7, pp. 3–9.) Reprint of 751 of 1941.

621.396.621 **1462**

Radiomobile Model 100.—(*Wireless World*, Feb. 1948, Vol. 54, No. 2, pp. 48–50.) A broadcast receiver with push-button tuning, for car use. Input is 3.25 A at 12 V; output is 3.5 W. Full circuit and component details are given.

621.396.621 **1463**

"Merkur W" [receiver].—V. Stuzzi. (*Radio Tech., Vienna*, 1947, Vol. 23, Nos. 8/9, pp. 391–392.) Circuit details of an a.c. 4-stage receiver for short and medium waves, using valves of the E21 series.

621.396.621 **1464**

A Receiver for the Amateur Bands.—L. F. Worssam. (*R.S.G.B. Bull.*, Jan. 1948, Vol. 23, No. 7, pp. 130–134.) Circuit and construction details of an 11-valve superheterodyne receiver with good performance over the frequency range 1.7–60 Mc/s. It uses plug-in coils and has two r.f. stages, a two-valve frequency changer, three i.f. stages at 1.6 Mc/s, second detector, beat frequency oscillator, noise limiter, two a.f. stages, power supply and a voltage stabilizer.

621.396.621 : 621.396.645.371 **1465**

Selectivity by Counter-Reaction.—X. de Maistre. (*Radio franç.*, Jan. 1948, pp. 8–11.) Further discussion, with practical results. For earlier work, see 1041 of 1947.

621.396.621 : 621.396.662 **1466**

Reactance Adjustment of Oscillator Coils.—(*Philips tech. Commun., Aust.*, Dec. 1946, No. 7, pp. 10–13.) Padding errors encountered in radio receivers are shown to be mainly due to the self-capacitance of the oscillator coils. By adjusting coils so that their reactance is correct at the central tracking crossover frequency, instead of adjusting the inductance to the correct value, this trouble is eliminated.

621.396.621 : 621.396.662 **1467**

Station Selection with Frequency Modulation Receivers.—E. G. Beard. (*Philips tech. Commun., Aust.*, Sept. 1946, No. 4, pp. 17–24.) Severe harmonic distortion and false tuning positions may be caused by the tuned circuits in f.m. receivers. The 'skirts' of the resonance curves of the tuned circuits in a f.m. receiver should fall in the gaps between f.m. channels and the width of the gaps affects the least permissible Q of the tuned circuits if interference from adjacent channels is to be avoided.

621.396.621 : 621.396.8 **1468**

Sensitivity of Broadcast Receivers.—A. Lennartz. (*Funk u. Ton*, Nov. 1947, No. 5, pp. 251–256.) Sensitivity is defined and its limitation by noise voltages is discussed. The design of receiver input circuits is considered with special reference to noise reduction and optimum sensitivity.

621.396.621.001.4 : 621.396.615.17 : 621.396.822 **1469**

Impulse Noise Generator for Testing F.M. Receivers.—Tellier. (*See* 1418.)

621.396.621.029.62 **1470**

The Varif — A New Receiver for 2 Meters.—L. P. Neal & H. B. Wells. (*CQ*, Nov. 1947, Vol. 3, No. 11, pp. 15–19, 99.) A superheterodyne receiver with good sensitivity and including a noise limiter. Uniform gain is combined with continuously variable bandwidth.

621.396.621.53 **1471**

Broad-Band Crystal-Controlled 10-Meter Converter for the Car.—N. F. Ennis. (*CQ*, Dec. 1947, Vol. 3, No. 12, pp. 27–29..87.) A frequency-changer for tuning to 10 m with a broadcast receiver. Stability is comparable to that of l.f. stations. Full circuit details are given.

621.396.621.54 **1472**

Wide-Band Superhet A.M. Tuner.—M. O. Kappler. (*Communications*, Dec. 1947, Vol. 27, No. 12, pp. 20–22..39.) A receiver in which background valve noise is considerably reduced by using Ge-crystal rectifiers in a balanced bridge circuit as the mixer unit. Other features include broad-band i.f., infinite-impedance second detector, and a tuning meter arranged to show a dip in the centre of the broad i.f. pass band.

621.396.621.54 : 518.4 **1473**

Abacs for the Calculation of the Oscillatory Circuits of Superheterodynes.—R. Bussat. (*Radio franç.*, Dec. 1947, pp. 14–16.) Since experiment is usually found necessary for checking calculations of these circuits, abacs would appear to provide the ideal method of obtaining approximate values of the circuit components. The abacs here given meet all practical requirements.

621.396.622 **1474**

On the Detection of U.H.F. Oscillations.—E. S. Antseliovich. (*Zh. tekh. Fiz.*, 1947, Vol. 17, No. 4, pp. 443–450. In Russian.) An approximate method for designing a rectifier circuit is proposed. Parasitic capacitance is discussed in detail, and methods for reducing its effects are suggested.

621.396.622 **1475**

Performance Characteristics of F.M. Detector Systems.—B. D. Loughlin. (*Tele-Tech*, Jan. 1948, Vol. 7, No. 1, pp. 30–34.) A detector system using a diode as a dynamic limiter, and with a variable threshold level, is described and its operation analysed. The characteristics of other f.m. detectors, using grid-bias limiters, locked oscillators, or ratio detectors, are discussed.

621.396.622.71 **1476**

Improved Type of Ratio Detector.—A. E. Hayes, Jr. (*Tele-Tech*, Nov. 1947, Vol. 6, No. 11, pp. 41..96.) Discussion of a degenerative feedback circuit which secures efficient f.m. detection while maintaining satisfactory a.m. rejection. See also 3643 of 1947 (Seeley & Avins) and 248 of January.

621.396.667 **1477**

A Quality Switch in Lieu of a Tone Control.—E. G. Beard. (*Philips tech. Commun., Aust.*, Feb. 1947, No. 2, pp. 8–11, 7.) The advantages of a quality switch as compared with a continuous tone control are discussed and details of a practical circuit are given.

621.396.82 + 621.396.11 **1478**

Radio Propagation in the Frequency Range 40-100 Mc/s.—T. W. Bennington. (*B.B.C. Quart.*, Jan. 1948, Vol. 2, No. 4, pp. 233–243.) Interference with local short-distance transmissions due to long-distance propagation of h.f. waves is discussed. F-layer propagation will cause long-distance interference on frequencies of 40–50 Mc/s, and can take place during daylight at the equinoxes and during the winters of years near sunspot maxima, but will be very infrequent above 48 Mc/s. Sporadic-E propagation will also cause intolerable medium-distance interference during the day in summer. This will occur in the frequency range 40–53 Mc/s but can be neglected above 53 Mc/s. Medium-distance interference can also be caused over the whole range of 40–100 Mc/s by tropospheric propagation. This will be prevalent during the hours of darkness in summer, but weak and rare enough to be tolerated from transmission distances greater than a few hundred miles.

621.396.82 : 621.396.662.3 **1479**

Cavity Type Filters for Interference.—D. E. Noble. (*Tele-Tech*, Jan. 1948, Vol. 7, No. 1, pp. 35–37..86.) Cavity filters can be effectively used by mobile R/T services, operating on neighbouring frequencies, to eliminate or reduce interference and so make the best use of the frequencies available. Examples show how receiver adjacent channel selectivity is improved, and cross modulation of adjacent transmitters reduced.

621.396.822 **1480**

Effect of the Fluctuations [noise] **and Signal Voltages on a Non-Linear System.**—V. Boonimovich. (*J. Phys., U.S.S.R.*, 1946, Vol. 10, No. 1, pp. 35–48.) A study of the analytical method using the correlation function and its relation to the intensity spectrum of the noise. The correlation functions for the noise from a simple tuned circuit, an ideal band-pass system, a Gaussian filter and from two coupled circuits are evaluated. The effect of a non-linear detector is treated in a general introductory manner. See also 440, 2168 and 2169 of 1945 (Rice).

621.396.822 **1481**

Method for determining Receiver Noise Figure.—M. Allen. (*Tele-Tech*, Jan. 1948, Vol. 7, No. 1, pp. 38–39..78.) The receiver output is compared with that of an ideal receiver whose output results solely from the thermal agitation noise developed across a resistance equal to the radiation resistance of the aerial. The noise factor is calculated in terms of the effective bandwidth of the receiver, its effective input resistance, and the values of receiver output without and with a known input signal. A numerical example is given for a 5-stage radar receiver.

621.396.822 **1482**

Noise Factor, Its Practical Calculation and Measurement.—W. Daudt. (*Funk u. Ton*, Oct. 1947, No. 4, pp. 191–199.)

621.396.822 **1483**

Random Noise in Radio Receivers.—E. G. Beard. (*Philips tech. Commun., Aust.*, July 1946, No. 3, pp. 14–22.) "A brief explanation of the nature of impulsive and random noise is given. The input circuits to a radio receiver are then considered from the viewpoints of gain and noise separately, and the manner of arriving at the optimum compromise is explained. Optimum signal/noise ratio requires a tighter coupling than optimum gain."

621.396.822 : 621.317.7.089.6 **1484**

Factors affecting the Accuracy of Radio Noise Meters.—H. E. Dinger & H. G. Paine. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1947, Vol. 35, No. 12, pp. 1505–1507.) Discussion on 2227 of 1947.

621.396.822 : 621.385.3/.5 **1485**

Triode Mixer *vs* Pentode Amplifier.—J. Tannenbaum. (*QST*, Nov. 1947, Vol. 31, No. 11, pp. 30–31 . . 118.) Noise levels in triodes and pentodes are discussed. A 28-Mc/s weak-signal converter is described, in which one section of a 6J6 twin triode is used as a square-law converter and the other section as an oscillator. An i.f. of 6.8 Mc/s permits the converter to be coupled to most commercial receivers. Details of construction, operation and performance are given.

621.396.822.029.62 : 523.745 **1486**

Meeting of the Royal Astronomical Society [10th Oct. 1947].—(*See* 1355.)

621.396.828 : 621.396.622 **1487**

Noise Neutralizing Detector Circuit.—D. L. Hings & W. W. Garstang. (*Tele-Tech*, Jan. 1948, Vol. 7, No. 1, pp. 40–41.) A sideband acceptance circuit is connected in the detector circuit so as to modulate a locally generated carrier of suitable phase and amplitude. The resultant circuit combines the incoming carrier, damaged by noise, and the local carrier, modulated by noise, in such a way that the incoming carrier is restored to its original form without the noise.

STATIONS AND COMMUNICATION SYSTEMS

621.394.441 **1488**

Carrier-Frequency Telegraph Systems.—F. Lucantonio. (*Alta Frequenza*, Oct. 1947, Vol. 16, No. 5, pp. 242–265. In Italian, with English, French and German summaries.) A general account of voice-frequency systems.

621.395.44 **1489**

The S12-102 12-Channel Carrier-Current System.—M. Parmentier, J. L. Hurault & E. Boucherot. (*Câbles & Transmission, Paris*, Jan. 1948, Vol. 2, No. 1, pp. 31–50. With English summary.) Equipment to be used as a basis for most carrier systems at present envisaged is discussed in detail. The 12 channels are included in the frequency band 60–108 kc/s. Double modulation is used. The filters have only inductance coils and capacitors. The principal applications planned or actually in service are outlined.

621.395.44 : 621.315.052.63 **1490**

The Subscriber Terminal for Rural Power-Line Carrier.—L. Hochgraf. (*Bell Lab. Rec.*, Nov. 1947, Vol. 25, No. 11, pp. 413–417.) In the M1 carrier system, call signals are received as pulses which, after rectification, ring a bell. When the receiver is lifted, relays are operated to switch on the transmitter and connect it to the power line.

621.396.1 **1491**

How Rigid is the Hartley Law?—(*Tele-Tech*, Jan. 1948, Vol. 7, No. 1, pp. 52–53.) An extension of the law indicates that bandwidth can be increased if signal/noise ratio or power is reduced, and vice versa. Discussion shows that pulse count modulation gives high transmission efficiency.

621.396.1 **1492**

High Frequency Allocations Revised.—K. R. Boord. (*Radio News*, Dec. 1947, Vol. 38, No. 6, p. 132.) The new international radio allocations are given for h.f. broadcasting, tropical broadcasting and amateur use. These will have effect from January 1st, 1949 and will replace the regulations of the 1938 Cairo Conference. Future meetings of other international conferences on radio frequencies are also mentioned.

621.396.324 **1493**

Frequency-Shift Radio Teletype in World War II.—R. A. Vanderlippe. (*Bell Lab. Rec.*, Dec. 1947, Vol. 25, No. 12, pp. 442–446.) Frequency-shift methods of operating radio-telegraph systems reduce the effects of fading, since the carrier is radiated continuously and quick-acting a.v.c. can be used in the receiver. In teletypewriter systems, clear reception is important, as a lost or false pulse results in printing a wrong character. Frequency-shift systems, as used in conjunction with dual-diversity reception by the American services, are discussed. See also 3702 of 1947 (Wickizer).

621.396.619.11/.13 **1494**

2-Channel [communication system] **with F.M. and A.M.**—Etzold. (*Funk u. Ton*, 1947, No. 2, pp. 82–92.) An investigation of the effects of applying simultaneous f.m. and a.m. to a transmitter. An a.m. receiver was used, with rhythmic frequency sweep synchronized with the transmitter, thus providing a second channel.

621.396.619.13 **1495**

The Phasitron.—M. Adam. (*Télévis. franç.*, Nov. 1947, No. 31, pp. 20–24.) A detailed account of the construction and working, with an outline of its use for f.m. See also 2239 of 1947 (Adler).

621.396.619.13 **1496**

Frequency Modulation.—E. G. Beard. (*Philips tech. Commun., Aust.*, Jan. 1946, No. 1, pp. 3–30.) A chapter from the author's Manual of Radio Practice (2303 of 1947).

621.396.619.16 **1497**

Pulse Modulation.—J. Moline. (*Radio franç.*, Jan. 1948, pp. 3–8.) Definitions and a simple account of technique.

621.396.619.16 : 621.385.832 **1498**

Old and New Modulation Methods : Part 3 — Pulse Modulation.—W. Nowotny. (*Radio Tech., Vienna*, 1947, Vol. 23, Nos. 11/12, pp. 511–521.) A description of single- and multichannel p.m. transmission systems. Noise limitations, bandwidth and the various types of p.m. are discussed and an account is given of the use of the cyclophon for modulation and demodulation. See also 883 of March (Grieg, Glauber & Moskowitz) and back reference.

621.396.619.16 : 621.395.43 **1499**

Advanced Pulse Code Modulation System.—(*Tele-Tech*, Nov. 1947, Vol. 6, No. 11, pp. 31 . . 103.) Coding is simplified by the use of an electron beam which is modulated to scan a target plate perforated so as to give ' on ' or ' off ' pulses according to the code in use. For other accounts of pulse code modulation see 258 of January (Batcher), 545 of February (Goodall) and 818 of March.

621.396.712.2 : 621.317.32 **1500**

The Measurement of Circuit Voltages in a Studio Installation.—F. de Fremery & J. W. G. Wenke. (*Philips tech. Commun., Aust.*, Feb. 1947, No. 2, pp. 3–7.) Translated from an article in *Philips tech. Rev.* noted in 2722 of 1942. Describes a monitoring system for a broadcasting studio giving a meter indication of audio level with a rapid response to peaks of high level and a slower decay. A nearly linear decibel scale is obtained by using a nonlinear potential divider between the diode peak voltmeter and the d.c. amplifier. A selenium rectifier and a resistor with the same temperature coefficient are used to avoid effects due to changes of ambient temperature.

621.396.933 + 621.396.96 **1501**

Air-Line Radio.—(*Wireless World*, Jan. 1948, Vol. 54, No. 1, p. 28.) Photograph and brief description of radio equipment installed in an aircraft of British South American Airways.

SUBSIDIARY APPARATUS

621.318.572 : [621.395.623.8 + 621.396.61 **1502**

An Experiment in Voice Controlled Relays.—L. A. Wortman. (*Radio News*, Dec. 1947, Vol. 38, No. 6, pp. 56–57 . . 162.) A voltage, derived from a speech-modulated input, actuates a relay switch in another circuit. A time-delay circuit prevents the relay from attempting to follow each word. Operating details and circuit diagrams are given for a loudspeaker address system and a R/T transmitter.

621.396.68 : 621.316.722 **1503**

Ripple Current through Input Capacitor in Half-Wave Rectifiers.—M. J. Kobilsky & J. Tepper. (*Philips tech. Commun., Aust.*, Oct. 1946, No. 5, pp. 21–24.) Measurements on power supply units for a.c./d.c. receivers are described and a curve is given for accurate prediction of ripple current.

TELEVISION AND PHOTOTELEGRAPHY

06.064 : 621.396/.397 **1504**

Television Topics dominate N.A.B. Technical Conference.—(*Tele-Tech*, Nov. 1947, Vol. 6, No. 11, pp. 56–59 . . 104.) Report of 1947 National Association of Broadcasters' Convention. A demonstration of large-screen television projection was given. The use of empirical formulae, recent advances in studio equipment, maintenance of transmitters and aerials, broadcasting standards, and aerials for circular polarization, were also discussed.

621.397.331.2 **1505**

Television Tubes by the Thousands.—F. E. Butler. (*Radio News*, Dec. 1947, Vol. 38, No. 6, pp. 39–42 . . 171.) General description of the processes of manufacture.

621.397.331.2 **1506**

New Television Field-Pickup Equipment employing the Image Orthicon.—J. H. Roe. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1947, Vol. 35, No. 12, pp. 1532–1546.) A general description of the main units, with discussion of special features of some of the circuits used.

621.397.62.001.41 : 621.317.79 : 621.396.615 **1507**

Generator for Alignment of Television Receiver Circuits.—Lecointe. (*See* 1415.)

TRANSMISSION

621.396.61.029.62 **1508**

Miniature Ten Meter Phone Transmitter.—D. R. Rhodes. (*Radio News*, Dec. 1947, Vol. 38, No. 6, pp. 60–61 . . 138.) Conventional circuit, using miniature components, gives good signal strength. Ranges up to 3 000 miles can be obtained with input power of 2 W to the final amplifier.

621.396.61/.62].029.63 **1509**

Four-Twenty is Fun!—E. P. Tilton. (*QST*, Nov. 1947, Vol. 31, No. 11, pp. 13–16.) The construction of a superregenerative receiver and a simple low-power transmitter for 420 Mc/s. The transmitter may be built from standard components or the war-surplus equipment AN/APS-13 may be included.

VALVES AND THERMIONICS

621.383 : 537.311.3 **1510**

Conductivity of Evaporated Films of Lead Selenide.—Simpson. (*See* 1376.)

621.383 : [546.86 + 546.36 **1511**

The Photoelectric Properties of Antimony-Caesium Photocells for Transmitted Light as determined by Their Thickness.—D. M. Khorosh. (*Zh. tekh. Fiz.*, 1947, Vol. 17, No. 3, pp. 341–348. In Russian.) The effect of the thickness of the antimony layer on the spectral characteristic of the photocell was investigated experimentally. The layer thickness necessary for obtaining the maximum sensitivity was determined. The light absorption characteristics for various thicknesses of the layer are plotted.

621.385 **1512**

Type ECH-35 Triode Hexode.—(*Philips tech. Commun., Aust.*, April 1946, No. 2, pp. 12–21.) Description with complete electrical data and characteristics.

621.385.1 + 621.392 + 621.396.694.012.8 **1513**

Circuits and Valves in Electronics: Part 2.—Charbonnier & Royer. (*See* 1291.)

621.385.3/.5 : 621.396.822 **1514**

Triode Mixer *vs* Pentode Amplifier.—Tannenbaum. (*See* 1485.)

621.396.615.141.2 **1515**

Wavelength Laws of Split Anode Magnetrons.—G. H. Metson. (*Wireless Engr*, Dec. 1947, Vol. 24, No. 291, pp. 352–356.) The 'negative resistance' mode of oscillation of a split-anode magnetron, in which the generated frequency is within wide limits independent of time of electron flight, obeys the law $\lambda = ml + c$, where l is the length of the Lecher line resonator and m and c are constants for a given magnetron. This law is reconciled with that for a resonant Lecher line, $\lambda/4 = l$, the constant $c/4$ being shown to represent a length of line which would have substantially the same equivalent capacitance as the inter-anode capacitance of the magnetron.

621.396.615.141.2 **1516**

Oscillations in a Two-Segment Magnetron loaded with a Lecher System.—S. D. Gvozdover & E. M. Moroz. (*Zh. tekh. Fiz.*, 1947, Vol. 17, No. 7, pp. 819–828. In Russian.) A Lecher system of variable length is connected to two anode segments of a magnetron (Fig. 1). Formulae determining the frequency of the system (8), stationary amplitude

(9), condition for self-excitation (11) and condition for stability (13) are derived. The influence of skin effect on self-excitation is discussed in detail and the stationary amplitude under various operating conditions is also examined. Curves are plotted in Figs. 3 and 4 showing respectively the limiting values of the operating wavelengths and of the lengths of the Lecher system. The conclusions reached agree with published experimental results.

621.396.615.141.2 : 533.59 **1517**

The Effect of the Degree of Vacuum on the Frequency of a Decimetre-Wave Magnetron Oscillator.—A. P. Maydanov. (*Zh. tekh. Fiz.*, 1947, Vol. 17, No. 3, pp. 283–290. In Russian.) An experimental investigation with vacuum varying from 10^{-6} to 10^{-3} mm Hg. A rapid and comparatively accurate method of frequency measurement was developed and a number of experimental curves are shown.

621.396.615.142 : 621.396.621.54 : 621.396.96 **1518**

Reflex Oscillators for Radar Systems.—J. O. McNally & W. G. Shepherd. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1947, Vol. 35, No. 12, pp. 1424–1435.) The requirements for beating oscillators, with descriptions of typical valves and discussion of their characteristics. Difficulties encountered in the development and the methods of overcoming them are outlined. These included 'electronic hysteresis', broad-band operation of reflex oscillators and thermal tuning of an internal cavity. Summaries noted in 1026 and 3057 of 1947.

621.396.615.142.2 **1519**

The Manufacture of a Reflex Klystron.—D. L. Hollway. (*Proc. Instn Radio Engrs, Aust.*, Oct. 1947, Vol. 8, No. 10, pp. 4–15.) An outline of the techniques and equipment used in Australia for the CV35. Methods are described for sealing copper disks to glass tubes by h.f. heating and for inspecting strains in glass parts by use of polarized light. Modifications of the design increased the tolerances and improved the grid control characteristics.

621.396.822 **1520**

A Method for Experimental Investigation of the Statistics of Electric Fluctuations.—E. J. Pumper. (*C. R. Acad. Sci. U.R.S.S.*, 10th July 1946, Vol. 53, No. 1, pp. 25–27. In English.)

MISCELLANEOUS

025.45 **1521**

Universal Decimal Classification.—An abridged English edition of the U.D.C. system will be issued as British Standard 1000A in the near future by the British Standards Institution, 24–28 Victoria Street, London, S.W.1, price 25s. More detailed information about various sections of the U.D.C. can also be obtained from the Institution.

The classification of the vast majority of these abstracts is covered by British Standard 1000 Vol. 1, Part 1, Vol. 2, Parts 1–3, and Vol. 4, Part 2.

06.064 : 621.396/.397 **1522**

Television Topics dominate N.A.B. Technical Conference.—(*See* 1514.)

06.064 London : 621.396 **1523**

The Amateur Radio Exhibition.—(*R.S.G.B. Bull.*, Dec. 1947, Vol. 23, No. 6, pp. 112–115, 108.) A summary of Sir Stanley Angwin's opening speech and a short account of some of the exhibits. See also *Wireless World*, January 1948, Vol. 54, No. 1, pp. 14–15.

621.3 General Electric **1524**

The Research Laboratories of the General Electric Company.—C. C. Paterson. (*Proc. roy. Soc. A*, 3rd Dec. 1947, Vol. 191, No. 1027, pp. 417–428.) A discussion primarily of the way the staff of the laboratories have learnt from their experience to go about their work. The need for an intimate connection between the factory and the laboratory is stressed. A brief discussion is given of a few general examples of assistance given by the laboratories.

621.396.97 **1525**

Broadcasting Jubilee.—P. P. Eckersley. (*Wireless World*, Dec. 1947, Vol. 53, No. 12, pp. 454–456.) Genuine high-fidelity reproduction is impossible on medium and long wavelengths, and on short wavelengths using f.m. there is the disadvantage of a complicated receiver. The use of wire broadcasting is advocated and television should be developed in conjunction with the cinema.

016 : 6(43)+6(52) **1526**

Reports on German and Japanese Industry. [Book Notice]—H. M. Stationery Office, London, 1947. Classified List No. 8 (88 pp., 1s.) deals with material published on or before 31st May 1947. Material published in June 1947 is covered in Classified List No. 9 (8 pp., 2d.) and similar lists are available for later months.

058 : 621.001 **1527**

Industrial Research 1947. [Book Notice]—P. Dunsheath (Ed.). Todd Publishing Co., London, 1947, 534 pp. A collection, published annually, of general information, including: (*a*) directories of various bodies undertaking or concerned with research, both in England and overseas, (*b*) personnel, terms of reference, and summaries of recent reports of various officially appointed committees, (*c*) information about books, periodicals, libraries, films and abstracting organizations.

62(083.74) **1528**

[British Standards Institution] **Yearbook.** [Book Notice]—British Standards Institution, 28 Victoria Street, London, 1947, 3s. 6d. (*Brit. Stand. Instn Mon. Inf. Sheet*, Jan. 1948, p. 2.) Contains a numerical list of British Standards with a synopsis of each and a subject index.

621.396/.397(47) **1529**

Radio Symposium. [Book Notice]—Central Technical Information Bureau of the U.S.S.R. Ministry of the Communications Industry, Moscow, 184 pp. (*Radiotekhnika, Moscow*, 1947, No. 7, p. 72. In Russian.) Prepared for the Russian 'Radio Day' in 1947. The book contains 18 articles on various aspects of radio broadcasting and reception, including television.

621.396 **1530**

Radio-Technik, Theorie und Praxis. [Book Review]—J. Dürrwang. Wepf & Co., Basel, 5th edn, 216 pp., 12 Swiss francs. (*Wireless Engr*, Oct. 1947, Vol. 24, No. 289, p. 308.) A non-mathematical book intended for seriously minded amateurs and radio technicians, covering the whole field of radio from Ohm's law to radar and television.

ABSTRACTS and REFERENCES

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to the World List practice.

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ACOUSTICS AND AUDIO FREQUENCIES

016 : 534 **1531**

References to Contemporary Papers on Acoustics.—A. Taber Jones. (*J. acoust. Soc. Amer.*, Jan. 1948, Vol. 20, No. 1, pp. 72–78.) Continuation of 908 of April.

534.321.9 **1532**

Absorption of Ultrasonic Waves in Liquids.—(*Nature, Lond.*, 27th Dec. 1947, Vol. 160, No. 4078, pp. 913–914.) Short account of a Physical Society discussion.

534.422 : 534.7 **1533**

Some Biological Effects of Intense High Frequency Airborne Sound.—C. H. Allen, H. Frings & I. Rudnick. (*J. acoust. Soc. Amer.*, Jan. 1948, Vol. 20, No. 1, pp. 62–65.) A 20-kc/s siren provided a sound intensity of about 160 db above 10^{-16} W/cm^2, which was sufficient to kill mice and insects by the heating produced by sound absorption. Effects on the observers, such as dizziness and fatigue, are described. See also 922 of April (White).

534.6 **1534**

A Mobile Laboratory for Acoustical Work.—W. C. Copeland. (*J. sci. Instrum.*, March 1948, Vol. 25, No. 3, pp. 82–85.) A detailed description of equipment designed by the Acoustics Section of the National Physical Laboratory for field work. Power is normally obtained from local mains, but a battery supply is available. Special methods of mounting are used to minimize damage by vibration; the necessary long cables (100 yards) are carried on eight drums located at the rear of the outfit.

534.75/.76 **1535**

Monaural and Binaural Threshold Sensitivity for Tones and for White Noise.—I. Pollack. (*J. acoust. Soc. Amer.*, Jan. 1948, Vol. 20, No. 1, pp. 52–57.) The binaural threshold was found to be significantly lower than the monaural threshold only when the difference in sensitivity of the two ears was artificially cancelled. The difference between the thresholds was significantly greater for a pure tone than for noise.

534.75 **1536**

The Effect of Noise in One Ear upon the Loudness of Speech in the Other Ear.—J. P. Egan. (*J. acoust. Soc. Amer.*, Jan. 1948, Vol. 20, No. 1, pp. 58–62.)

534.78 **1537**

Effects of Differentiation, Integration, and Infinite Peak Clipping upon the Intelligibility of Speech.—J. C. R. Licklider & I. Pollack. (*J. acoust. Soc. Amer.*, Jan. 1948, Vol. 20, No. 1, pp. 42–51.) Subjective articulation tests showed that intelligibility was reduced very little by differentiation or integration of the speech waves. Infinite clipping (reduction of speech to a succession of rectangular waves of uniform amplitude in which the discontinuities corresponded to the crossings of the time-axis in the original signal) and combinations of clipping, differentiating and/or integrating reduced intelligibility, but in all the cases considered intelligible conversation was possible.

534.851 : 621.395.625.2 **1538**

Noise Modulation in Recording.—E. G. Cook. (*Audio Engng, N.Y.*, Dec. 1947, Vol. 31, No. 11, pp. 8–11.) Causes are discussed, with particular reference to the effects due to inclination between the normal to the stylus face and the direction of the groove. Methods of measuring noise modulation are outlined and an arbitrary stylus factor-of-merit is suggested.

534.861.1/.2 **1539**

Broadcasting Studio Pickup Technique.—H. M. Gurin. (*Audio Engng, N.Y.*, Feb. 1948, Vol. 32, No. 2, pp. 9–14, 48.) Discussion of the factors influencing the selection of positions for microphones and for performers in broadcasting studios.

534.861.1 : 621.395.623.8 **1540**

Broadcasting Studio Sound Reinforcement.—H. A. Chinn & R. B. Monroe. (*Audio Engng, N.Y.*, Dec. 1947, Vol. 31, No. 11, pp. 5–7 . . 38.) Systems used in the C.B.S. studios.

534.862 **1541**

Cinema Photoelectric [sound] **Reproduction.**—H. Sapiens. (*Toute la Radio*, Jan. 1948, Vol. 15, No. 122, pp. 39–42.) A short account of general principles, with descriptions of the optical systems of a few commercial types.

534.87 **1542**

Underwater Sound Transducers.—H. F. Olson, R. A. Hackley, A. R. Morgan & J. Preston. (*RCA Rev.*, Dec. 1947, Vol. 8, No. 4, pp. 698–718.) An account of various types of transmitters and receivers for underwater sounds.

621.395.61 : 534.43 : 621.385.1 **1543**

A Vacuum-Tube-Type Transducer for Use in the Reproduction of Lateral Phonograph Recordings.—Gordon. (*See* 1820.)

621.395.623.8 **1544**

Sound Reinforcement in the Hollywood Bowl.—M. Rettinger & S. M. Stevens. (*Audio Engng, N.Y.*, Feb. 1948, Vol. 32, No. 2, pp. 15–17 . . 43.) Mechanical and acoustical features of the R.C.A. two-way loudspeaker system installed in 1947.

621.395.625 **1545**

The Recording and Reproduction of Sound : Parts 8-10.—O. Read. (*Radio News*, Oct.–Dec. 1947, Vol. 38, Nos. 4–6, pp. 51–53 . . 156, 48–50 . . 163 & 48–50 . . 115.) Part 8 : Discussion of crystal cartridges and coupling methods. Part 9 : Magnetic reproducers of various types. Part 10 : Discussion of two representative tuners. For earlier parts, see 3771 and 3772 of 1947. To be continued.

621.395.625.2 **1546**

Sound Recording by Engraving on Film.—M. Adam. (*Tech. mod., Paris*, 1st/15th Jan. 1948, Vol. 40, Nos. 1/2, pp. 21–23.) Recording is effected on a celluloid film covered with a layer of transparent gelatine of thickness 60 μ, on which is deposited a thin opaque layer of thickness about 3 μ. A chisel stylus with a 174° V-edge cuts a groove of varying width in the gelatine film. Reproduction is exactly the same as with films obtained by optical processes. A great advantage of the system is that records can be reproduced immediately, as no developing, drying, etc., is required.

621.395.813 : 534.75 **1547**

Sensitivity of the Ear to Phase Distortion: — Experimental Demonstration.—G. Zanarini. (*Radio franç.*, Feb. 1948, pp. 30–32.) Translation from an article in *Elettronica*, Aug. 1947. Tests were carried out with apparatus in which a network producing a rapid phase variation, while maintaining a constant output voltage, could be inserted at will between a receiver and a loudspeaker amplifier. The results showed that in the electroacoustic reproduction of sound, phase displacement is perceptible when it reaches a sufficiently high value and when the sounds have a transient character. With the type of circuit normally used, the phase distortion is too small to be perceptible, but certain types of correction network may produce perceptible effects.

534 **1548**

Elements of Acoustical Engineering. [Book Review]—H. F. Olson. D. Van Nostrand, New York, 2nd edn 1947, 539 pp., $7.50. (*Electronics*, Feb. 1948, Vol. 21, No. 2, pp. 252, 254.) Each chapter of the first edition (noted in 124 of 1941) is brought up to date and amplified. "An outstanding book in this field."

AERIALS AND TRANSMISSION LINES

621.315.09 **1549**

Note on the Propagation of Electricity along a Non-Uniform Cable.—M. Parodi. (*Rev. gén. Élect.*, Jan. 1948, Vol. 57, No. 1, pp. 37–38.) By using an invariant of the wave-propagation equation, a family of non-uniform lines can be found for which the propagation conditions can at once be deduced from those of a given non-uniform Thomson cable.

621.315.2 **1550**

High-Frequency Cable Design.—K. H. Zimmermann. (*Electronics*, Feb. 1948, Vol. 21, No. 2, pp. 112–115.) Practical design equations and two abacs for calculation of characteristic impedance, inductance, time delay and power rating for solid-dielectric, coaxial and two-conductor h.f. and v.h.f. balanced lines. A typical polyethylene cable design problem is worked out.

621.315.21 : 621.317.74 **1551**

The Measurement of the Propagation Constants of Screened Twin Cables.—Essen. (*See* 1689.)

621.392 : [621.317.336 + 621.317.341 **1552**

Method of measuring Feeder Parameters.—Kaganovich. (*See* 1677.)

621.392.029.64 : 621.3.09 **1553**

On the Propagation of Plane Waves in a Straight Metal Guide of Any Cross-Section.—R. Rigal & J. Voge. (*C. R. Acad. Sci., Paris*, 26th Jan. 1948, Vol. 226, No. 4, pp. 326–328.) Formulae are derived from which the propagation characteristics, including phase and group velocities, cut-off frequency, reflections at discontinuities, etc., can easily be deduced.

621.392.029.64 : 621.3.09 **1554**

Wave Propagation in Metal Tubes.—P. G. Violet. (*Funk u. Ton*, Jan. & Feb. 1948, Nos. 1 & 2, pp. 38–46 & 88–94.) Formulae are derived for E_0 and H_0 waves ; the limiting conditions at the tube walls, the propagation characteristics, and the shape of the field for these waves are discussed. Formulae for the attenuation in tubes of finite conductivity are given and harmonics of the E_0 and H_0 waves, and waves of higher order, are briefly considered.

621.392.029.64 : 621.3.09 **1555**

Slow Propagation of TM Waves in Cylindrical Waveguides.—G. G. Bruck & E. R. Wicher. (*Onde élect.*, Dec. 1947, Vol. 27, No. 249, pp. 470–472.) The physical basis of the action of linear electron accelerators and of travelling-wave valves is the reduction of the phase velocity of TM waves to a fraction of that of light. The complex forms of the waveguide walls normally used for this velocity reduction make exact calculation impossible. The phase-velocity can also be reduced by coating the wall of the waveguide with dielectric. Calculation in this case is both easier and more exact. Diagrams are given of field and energy distributions for three cases of practical interest.

621.392.091 **1556**

Attenuation in Compound Lines.—P. Marmet. (*C. R. Acad. Sci., Paris*, 10th Dec. 1947, Vol. 225, No. 23, pp. 1132–1133.) The term 'compound line' is applied to a series AB of n homogeneous lines terminated by impedances Z_A, Z_B and fed by an e.m.f. E, of zero impedance, in series either with Z_A or Z_B. Theoretical treatment shows that for such a line the attenuation of e.m.f. in one direction is equal to the current attenuation in the opposite direction. Formulae are derived for the parameters at any point of the line.

621.392.43 : 518.4 **1557**

Mismatch Loss Chart for Transmission Lines.—J. M. Hollywood. (*Electronics*, Jan. 1948, Vol. 21, No. 1, p. 130.) Loss due to mismatch between load and line impedance is given in terms of total rated loss of line and s.w.r. at loaded end.

621.396.67 **1558**

Current Distribution in Aerials.—R. Gans. (*Rev. sci., Paris*, 1st July 1947, Vol. 85, No. 3276, pp. 643–648.) A method of calculation is described which is based on the theory of Hallén. The discussion is restricted to the case of a rectilinear aerial extending from $z = -l$ to $z = +l$, although the theory can also be applied to curved aerials.

621.396.67 : 621.317.336 **1559**

Measurement of the Impedance of an Aerial.—Mourmant. (*See* 1678.)

621.396.67 : 621.396.933 **1560**

Circularly Polarized Antennas for Aircraft Communication.—J. P. Shanklin. (*Tele-Tech*, Dec. 1947, Vol. 6, No. 12, pp. 36–40, 90.) Discussion of the design of a 3-dipole aerial system for 120 Mc/s giving approximately circular polarization. The problems involved and the method of analysing the experimental data are considered and various polar diagrams are given.

621.396.67.029.64 **1561**

Systems of Slots in the Wall of a Circular Waveguide giving a Spindle-Shaped Radiation Diagram.—Z. Szepesi. (*C. R. Acad. Sci., Paris*, 15th March 1948, Vol. 226, No. 11, pp. 883–885.) A continuation of the work of Benoit (957 of April). To obtain a narrow radiation diagram in the horizontal plane, a multi-slot system is used, with suitable phase differences for the successive slots, the differences being obtained by displacing the slots parallel to the axis of the waveguide. A phase difference of 180° can be obtained by reversing the slope of the slot without axial displacement. Axial displacement can be avoided by changing the length of the slots; parasitic lobes are reduced by giving the middle slots a greater slope than the outer ones. Addition of a second series of slots at a distance of $\lambda_g/2$ from the first, with the slope of the slots reversed, gives a narrow beam in the vertical plane. A combination of short and long longitudinal slots with interposed inclined slots gives the equivalent of two Yagi arrays with a third driven aerial, the long slots acting as reflectors and the short as directors.

621.396.671 : 538.566 **1562**

On the Application of the Kirchhoff-Huyghens Principle to Electromagnetic Radiation Fields, with Examples.—Zuhrt. (*See* 1624.)

621.396.672 : 621.396.621 **1563**

Capacity Aerials for Mains Receivers.—(*Philips tech. Commun., Aust.*, March 1947, No. 3, pp. 24–26.) Experiments show that when a metal-plate or wire-grid aerial is used, the power mains actually function as the aerial while the plate acts as a counterpoise. Methods of connecting plate aerials are briefly discussed and a circuit diagram is given of an arrangement suitable for testing receivers fitted with plate aerials.

621.392.029.64 **1564**

Micro-Waves and Wave Guides. [Book Review]—H. M. Barlow. Constable, London, 122 pp., 15s. (*Electronic Engng*, Feb. 1948, Vol. 20, No. 240, pp. 66–67.) A simple and compact introduction to the study of microwaves, adapted to the needs of those readers who possess little previous knowledge of the subject.

CIRCUITS AND CIRCUIT ELEMENTS

621.314.2.015.33 **1565**

Pulse Transformers.—F. V. Lukin. (*Radiotekhnika, Moscow*, April 1947, Vol. 2, No. 4, pp. 46–61. In Russian, with English summary.) Discusses the equivalent circuit reduced to unity turn ratio and gives a graphical-analytical method of design.

621.314.3† **1566**

Magnetic Amplifiers: Parts 1 & 2.—S. E. Tweedy. (*Electronic Engng*, Feb. & March 1948, Vol. 20, Nos. 240 & 241, pp. 38–43 & 84–88.) In part 1, basic circuit arrangements known as 'transductors' (saturable twin-core reactors) are discussed. In part 2, the methods whereby these devices become magnetic amplifiers with high amplifications are considered. The advantages, construction and properties of magnetic amplifiers in various circuit connections are discussed, with particular reference to the magnetic photometer Type MAP1.

621.314.3† **1567**

Electromagnetic Amplifiers.—(*Electronics*, Jan. 1948, Vol. 21, No. 1, pp. 190 . . 195.) A brief discussion of general principles, with a bibliography of 35 items. See also 960 of April, and 664 of March.

621.316.078.3 **1568**

Study of the Stability of Systems capable of Mathematical Representation.—Y. Rocard. (*Rev. sci., Paris*, 15th May 1947, Vol. 85, No. 3273, pp. 519–531.) A discussion of linear systems for which the law may not be known. Curves representing impedance and phase paths are described and their use explained. Applications are considered to Nyquist curves for feedback amplifiers, to regulators and telecontrol apparatus, and to systems governed by functional equations. See also 2022 of 1947 (Frey) and back references.

621.316.726.078.3 : 621.396.615.142.2 **1569**

Stabilizing Frequency of Reflex Oscillators.—G. G. Bruck. (*Electronics*, Feb. 1948, Vol. 21, No. 2, pp. 170 . . 176.) An electronic duplex-heterodyne method for microwave generators which is simple and uses relatively few components. The frequency of a 10 000-Mc/s oscillator can be maintained within one part in 10^8.

621.317.733 **1570**

The D.C. Bridge with Nonlinear Resistances.—W. Schaaffs. (*Frequenz*, Nov. 1947, Vol. 1, No. 2, pp. 48–56.) The special features are discussed of many types in which valves, glow tubes, photocells, etc., are used as circuit elements. The voltage developed across the measurement diagonal is proportional to the variation of the supply voltage. The proportionality factor is equal to the ratio of the difference to the sum of the slopes of the current/voltage characteristics of the resistances in the bridge arms. The use of negative resistances is discussed and applications of bridges of this type are outlined. Voltage control to 1 part in 1 000 is easily obtained.

621.318.572 **1571**

A High Speed Coincidence Circuit.—R. H. Dicke. (*Rev. sci. Instrum.*, Dec. 1947, Vol. 18, No. 12, pp. 907–914.) Resolving time is of the order 10^{-9} – 10^{-10} sec. Experimental results are given.

621.318.572 **1572**

Phototube-Operated Trigger Circuit.—J. Degelman. (*Electronics*, Jan. 1948, Vol. 21, No. 1, pp. 134, 150.) A circuit for use when only a slight voltage variation is obtainable from a photocell; it acts as a sensitive d.c. amplifier.

621.318.572 **1573**

Relay Control Circuits for Stepping Switches.—C. J. Dorr & H. M. West. (*Electronics*, Jan. 1948, Vol. 21, No. 1, pp. 158..176.) A stepping magnet operates a pawl-and-ratchet mechanism so that 1, 2 or 3 wipers are moved one step forward over a bank of ten contacts at each current pulse.

621.392 : 621.385.832 : 518.5 **1574**

Numeroscope for Cathode-Ray Printing.—H. W. Fuller. (*Electronics*, Feb. 1948, Vol. 21, No. 2, pp. 98–102.) Circuit details of equipment generating waveforms which will display Arabic numerals on a c.r. screen. Photographic recording with exposures down to 0.002 sec is practicable. The device was developed for use with high speed electronic calculators where results are produced so quickly that conventional printing devices cannot keep up with the output of the machines.

621.392.4 **1575**

Stability Conditions for Nonlinear 2-Terminal Networks.—S. Malatesta. (*Alta Frequenza*, Feb. 1948, Vol. 17, No. 1, pp. 3–19. In Italian, with English, French and German summaries.) From the phase relations between current and voltage in a circuit comprising a nonlinear 2-terminal network (bipole), a resistor and a generator, general stability conditions are derived.

621.392.4 **1576**

Properties and Some Applications of Twin-T and Bridged-T Circuits.—I. Barta. (*Elektrotechnika, Budapest*, Dec. 1947, Vol. 39, No. 12, pp. 231–238. With English, French and German summaries.) General formulae are established for output voltage and for input and output impedances. Twin-T circuits with only resistors and capacitors, and bridged-T circuits using inductors, are discussed; applications to the measurement of distortion, frequency and inductance are considered.

621.392.5 **1577**

Simplified Method for calculating the Operational Properties of Chains of Quadripoles.—F. Strecker. (*Frequenz*, Nov. & Dec. 1947, Vol. 1, Nos. 2 & 3, pp. 41–48 & 77–85.) The wave theory of Hoecke is simplified and extended to the generalized quadripole. A general theory of quadripole chains is developed from which calculations of input resistance can be made without the use of tables for the reflection factor or for the arguments of complex hyperbolic functions.

621.392.5 : 534.321.9 **1578**

Ultrasonic Solid Delay Lines.—D. L. Arenberg. (*J. acoust. Soc. Amer.*, Jan. 1948, Vol. 20, No. 1, pp. 1–26.) Expressions based on electrical transmission-line formulae are used for determining delay, bandwidth, and attenuation of sound-waves in solids. The relationship between Poisson's ratio and angles of incidence for complete conversion of transverse to compressional mode, and vice versa, is obtained for various solids with a view to using multiple reflections to increase the delay obtainable in solids of small dimensions. Nicol prism and piezoelectric transducers are considered. Fused quartz is found to be the best substance to use, and the development of a delay line for the distortionless transmission of 1-μs pulses at ultrasonic frequencies of the order of 20 Mc/s, with a delay up to 2 ms, is discussed.

621.392.52 : 621.396.611.21 **1579**

Crystal Filters.—In 2701 of 1947, cancel the author's name as given, and substitute E. Istvánnffy.

621.396.611 **1580**

Optimum Conditions for an RC Oscillator.—H. A. Whale. (*Electronics*, Feb. 1948, Vol. 21, No. 2, pp. 178..186.) Relations between the values of components for optimum frequency stability of a particular RC network used in feedback oscillators of the Wien bridge type.

621.396.611.1 **1581**

Temperature Coefficients in Electronic Circuits.—C. I. Soucy. (*Electronics*, Jan. 1948, Vol. 21, No. 1, pp. 117–121.) The principal causes of frequency drift in tuned circuits are temperature effects in coils and coil formers, in fixed and variable capacitors, valves and wiring, and in resistors. With proper choice of components the frequency changes can be reduced very materially.

621.396.611.3 **1582**

An Experimental Investigation of the Mutual Synchronization of Two Coupled Thomson's Oscillators : Part 1 — Loose Coupling.—N. I. Esafov. (*Zh. tekh. Fiz.*, 1947, Vol. 17, No. 7, pp. 803–808. In Russian.) A system of equations (6) is derived from which the stationary amplitudes, and the frequency of the oscillations in the system can be determined. A report is also presented on experiments with two Hartley oscillators with power supplies in parallel (Fig. 2). Both oscillators are tuned to a frequency of 500 kc/s and the necessary detuning of one oscillator by an amount up to

56 kc/s was obtained by means of a variable capacitor. Experimental curves are plotted showing the variation of the amplitudes in the oscillating circuits, and the relative phase displacements for loose and tight couplings (Figs. 3 and 4 respectively). The case of tight coupling will be investigated more fully in a later paper.

621.396.615 **1583**
Harmonics in Oscillators.—A. S. Gladwin. (*Wireless Engr*, Jan. 1948, Vol. 25, No. 292, pp. 33–34.) Comment on 976 of April (Tillman). The 'energy balance' explanation of the frequency change produced by harmonics in an oscillator is critically discussed. It is suggested that Groszkowski gave an incorrect physical explanation of an accurate analytical formula. Correction, *ibid.*, March 1948, Vol. 25, No. 294, p. 98.

621.396.615.029.5 **1584**
H.F. Beat-Frequency Oscillator.—R. Aschen & J. Goutelle. (*Télévis. franç.*, Jan. 1948, No. 33, Supplement *Électronique*, pp. 35–39.) Description of the latest type, with suggested applications. See also 3827 of 1947 (Aschen & Lafargue) and back references.

621.396.615.14 **1585**
Some Notes on Oscillating Valve Circuits.—E. G. Beard. (*Philips tech. Commun., Aust.*, Oct. 1947, No. 9, pp. 6–18.) "A comparison of Colpitts, Hartley and Meissner oscillators for use at 100 Mc/s is made and reasons given for the choice of the Colpitts type for very high frequencies. Experiences with the type 6BE6 valve at 92 Mc/s are described. The circuit of a 'freak' oscillator is given. The difference between grid and anode limitation of oscillation amplitude is explained and some general problems in connection with oscillators are discussed. Circuits for an amplifier with gain stabilised by self-oscillation and for a double-frequency oscillator are developed."

621.396.615.14 **1586**
Push-Pull Resonant Line Oscillator for the 166–170 Mc/s V.H.F. Band.—G. Thompson. (*Philips tech. Commun., Aust.*, Nov. 1946, No. 6, pp. 7–11.) The construction of an experimental u.h.f. transmitter using resonant lines as tuned circuits in combination with a Type 800 valve is described. Technical data relating to this valve are included.

621.396.615.17 **1587**
Basic Design Principles for Sawtooth Current Generator.—V. F. Samoilov. (*Radiotekhnika, Moscow*, March 1947, Vol. 2, No. 3, pp. 63–77. In Russian, with English summary.) An approximate nonlinear treatment is presented of the phenomena in an oscillator with strong feedback, used to generate sawtooth currents. Graphs and formulae are derived for approximate calculation of the frequency and shape of the current pulses in deflection coils; these can assist in the choice of circuit parameters.

621.396.615.17 : 621.317.755 : 621.397.6 **1588**
Television Timebase.—Chauvierre. (*See* 1791.)

621.396.619.23 **1589**
Reactance Modulator Theory.—F. Butler. (*Wireless Engr*, March 1948, Vol. 25, No. 294, pp. 69–74.) "In the simplified analysis of reactance modulators, the loading effect of the phase-shifting circuit is commonly neglected. By considering the impedance of this circuit in parallel with that of the modulator valve it is possible to select the component values of the circuit so that the complete two-terminal network is purely reactive.

"The analysis covers both the conventional reactance modulator and the cathode-driven modulator. A simple bridge circuit is described, which may be used to determine the exact point of resistance neutralization."

621.396.619.23 **1590**
A 50-Watt Modulator with Peak Limiting.—R. Lewis. (*Radio News*, Nov. 1947, Vol. 38, No. 5, pp. 42–43..150.) For a 75-W amateur transmitter. A remote cut-off 6K7 pentode is used to eliminate blocking at unusually high signal levels; by using two valves in push-pull in the limiter stage and removing all filtering from the a.v.c. line, delay in limiter action is prevented.

621.396.621.54.001.8 **1591**
Superregenerative Circuit Applications.—H. Stockman. (*Electronics*, Feb. 1948, Vol. 21, No. 2, pp. 81–83.) Applications discussed include i.f.f. (identification), telemetering systems, radar beacons, remote-control devices and f.m. receivers. Empirical design considerations are discussed; basic circuit analysis is difficult.

621.396.645 **1592**
Reduction of Noise at U.H.F. in Triode Valves and Grounded Grid Amplifiers.—E. G. Beard. (*Philips tech. Commun., Aust.*, March 1947, No. 3, pp. 20–23.) Simplified summary of the principal conclusions of 3474 of 1947 (van der Ziel).

621.396.645 **1593**
The Cathode Follower: Parts 1–4.—E. Parker. (*Electronic Engng*, Jan.–April 1948, Vol. 20, Nos. 239–242, pp. 12–16, 55–58, 92–95 & 126–129, 131.) A logical and comprehensive development of the subject, including a number of new theorems and constructions. Parts 1 and 2 and the six appendices in part 4 cover linear theory; part 3 covers general theory and methods of constructing exact cathode-follower characteristics.

621.396.645 **1594**
Differential Input Circuits.—E. E. Suckling. (*Electronics*, Feb. 1948, Vol. 21, No. 2, pp. 186..190.) An improved version of the Toennies circuit (2096 of 1938).

621.396.645 : 621.317.755 **1595**
A High-Quality Amplifier for Application in Cathode-Ray Oscilloscopes.—C. J. Boers. (*Philips tech. Commun., Aust.*, April–July 1947, Nos. 4–6, pp. 11–15, 20–24 & 12–15.) Design of an amplifier with distortion-free performance at v.h.f. and suitable for modulating a c.r. tube with a screen 16 cm in diameter. The three parts deal respectively with a wide-range amplifier, an attenuator and a stabilized power supply. The design methods have other applications.

621.396.645 : 621.385.4 **1596**
Operating Conditions and Circuits for Valve Type 807.—Thompson. (*See* 1831.)

621.396.645.015.3 **1597**

Transients in a Multi-Stage Resonant Amplifier.—R. D. Leites. (*Radiotekhnika, Moscow,* March 1947, Vol. 2, No. 3, pp. 32–46. In Russian, with English summary.) Equations are derived for the envelopes of the output voltages of an n-stage resonant amplifier when pulse signals of various shapes are applied to the input terminals. It is shown that if $n>3$ or 4 and the overall frequency band is kept unchanged, the addition of extra stages has very little effect on the shape of the transient curve, which tends to a limiting curve; only the delay time is affected.

Equations are obtained for the limiting transient curves for input signals of various forms; these curves are used in an analysis of output distortion.

621.396.645.029.4 **1598**

Low-Frequency Amplifier with Variable Selectivity.—E. Gatti. (*Alta Frequenza,* Feb. 1948, Vol. 17, No. 1, pp. 20–31. In Italian, with English, French and German summaries.) Theory and experimental results are given for an amplifier with gain independent of frequency. A selective feedback network of the Scott type (1802 of 1938) is used. An equivalent Q of about 2 000 is obtained in the low a.f. range.

621.396.645.029.6 + 621.396.621.54.029.6 **1599**

Properties of Gain and Noise Figures at V.H.F. and U.H.F.—M. J. O. Strutt. (*Philips tech. Commun., Aust.,* March 1947, No. 3, pp. 3–16, 19.) Optimum stage gain of amplifiers and of mixers at v.h.f. and u.h.f. is derived for narrow-band and wide-band conditions. Five useful properties of noise figures relating to amplifiers and mixers are applied to obtain considerable noise reduction, in some cases amounting to 15 db at v.h.f. in mixer stages. A long summary of Strutt's lecture to the Swiss Federal Institute of Technology at Zürich dealing with the same subject is given in *Wireless Engr,* Jan. 1948, Vol. 25, No. 292, pp. 21–32. See also 3067 of 1947.

621.396.645.029.6 + 621.396.621.54.029.6 **1600**

Reduction of Noise in Amplifiers and Frequency Changers.—E. G. Beard. (*Philips tech. Commun., Aust.,* March 1947, No. 3, pp. 17–19.) Simplified summary of the principal conclusions of 1599 above.

621.396.645.2.029.4 **1601**

Low Frequency Compensation for Amplifiers.—K. Schlesinger. (*Electronics,* Feb. 1948, Vol. 21, No. 2, pp. 103–105.) Two interstage coupling networks for i.f. amplifiers are discussed and their design requirements analysed. One has a grounded load resistor, thus providing a low impedance output; the other requires very little capacitance.

621.396.645.35 **1602**

D.C. Amplifiers with Automatic Zero Adjustment and Input Current Compensation.—D. G. Prinz. (*J. sci. Instrum.,* Dec. 1947, Vol. 24, No. 12, pp. 328–331.) A negative-feedback system is used to charge a capacitor which is inserted in the input circuit of the amplifier to reduce the zero error.

621.396.645.36 **1603**

A New High Gain Phase Splitting Circuit.—E. G. Beard. (*Philips tech. Commun., Aust.,* Sept. 1947, No. 8, pp. 10–15.) Based on the use of a heptode mixing valve, such as ECH21; the heptode is used as a combined phase splitter and amplifier, while the triode unit is applied in automatic gain reduction.

621.396.645.371 **1604**

On Negative Feedback.—F. Benz. (*Radio Tech., Vienna,* Feb./March 1948, Vol. 24, Nos. 2/3, pp. 53–58.) A detailed discussion, including the effect on nonlinear distortion, improvement of the frequency curve for radio receivers and for sound reproduction, automatic loudspeaker control, increase of cut-off sharpness for l.f. filters, reduction of valve noise, etc.

621.396.645.371 **1605**

Counter-Reaction in Amplifiers.—L. Thourel. (*Radio franç.,* Dec. 1947, Jan. & Feb. 1948, pp. 3–6, 12–16 & 24–27.) Elementary theory is presented and a general formula given. Improvement of the amplitude-frequency curve, different types of counter-reaction, input and output impedances of an amplifier with counter-reaction and the cathode-follower circuit are discussed. Dephasing in l.f. and h.f. amplifiers is considered and the use of the counter-reaction polar diagram is explained. Correction circuits and amplifier bandwidth are also discussed briefly.

621.396.645.371 **1606**

Some Curious Counter-Reaction Circuits.—E. Aisberg. (*Toute la Radio,* Jan. 1948, Vol. 15, No. 122, pp. 34–38.) A simple explanation of the principle of counter-reaction, with practical circuits for volume expansion or compression, automatic tone control, so-called silent control, correction of loudspeaker resonances and attenuation of background noise and needle scratch.

621.396.645.371 **1607**

Evocation of a Virtual Triode.—L. Chrétien. (*Toute la Radio,* Jan. 1948, Vol. 15, No. 122, pp. 56–59.) A discussion of the application of counter-reaction in the final stage of amplifiers. When properly used, counter-reaction reduces amplitude, frequency and intermodulation distortion. If applied to an output pentode, the effect is to transform it into a virtual triode, which will have a set of virtual characteristics. These can be used in the usual way for calculating the stage gain, output power and relative distortion of the various harmonics.

621.396.645.371 : 534.43 : 621.395.61 **1608**

Feedback Preamplifier for Magnetic Pickups.—R. S. Burwen. (*Audio Engng, N.Y.,* Feb. 1948, Vol. 32, No. 2, pp. 18–20.) A simple design with low output impedance permitting the use of shielded coupling cable without causing severe attenuation of high frequencies. Negative feedback reduces harmonic distortion and also noise and hum originating in the preamplifier.

621.396.662 : 621.396.615 **1609**

Increasing the Efficiency of a High-Power H.F. Valve Oscillator by tuning to the Third Harmonic.—Z. I. Model, B. I. Ivanov, S. V. Person & G. F. Soloviev. (*Radiotekhnika, Moscow,* April 1947, Vol. 2, No. 4, pp. 15–23. In Russian, with English summary.) In many valve oscillators the h.f. anode voltage contains a pronounced third harmonic.

With additional anode-circuit tuning for this harmonic, an increased efficiency is obtained. A theoretical explanation is given.

621.396.662.21 **1610**

Temperature Coefficient Effects of R.F. Coil Finishes.—C. I. Soucy. (*Tele-Tech*, Dec. 1947, Vol. 6, No. 12, pp. 52–55 . . 93 & Jan. 1948, Vol. 7, No. 1, pp. 42–44 . . 79.) Frequency shift is plotted against temperature for various coil constructions and finishes. The optimum finish for stability and a fairly low temperature coefficient was obtained by applying a liquid polystyrene dope after baking, followed by a flash dip in Zophar wax No. 1436 at 250°F, the coil being preheated to 200°F.

621.396.662.3.015.3 **1611**

Transient Response of Symmetrical 4-Terminal Networks.—A. W. Glazier. (*Wireless Engr*, Jan. 1948, Vol. 25, No. 292, pp. 11–20.) The input and output currents I_s and I_r of a symmetrical 4-terminal network of transfer constant ϕ and image impedance Z_0, terminated with an impedance R_0 and connected to a generator of e.m.f. E and internal resistance R_0 can be written

$$I_s, I_r = \left[\frac{E}{2}\,\frac{1}{R_0 + Z_0 \tanh \phi/2} \pm \frac{1}{\mathrm{R}_0 + Z_0 \coth \phi/2}\right]$$

where the doubtful sign is + for I_s and − for I_r. These equations apply to steady-state or transient problems. An equivalent lattice network is deduced from the equations and discussed with particular reference to T, Π, and bridged-T networks.

The equations are also applied to the transient response of low-pass and high-pass filters, and that of 6-element band-pass and band-stop filters, all these filters being connected between resistive terminations; the responses are thus easily calculated. A 4-terminal network which, when short-circuited at the output and energized by receiving unit-step voltage input, has the same transient response as a transmission line with given distributed constants is also considered. See also 48 of 1947 (Eaglesfield) and back references.

621.396.662.3.029.62/.63 **1612**

Ultra-High Frequency Filters.—C. W. Oatley & C. M. Burrell. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 8, pp. 1338–1342.) An account of the measurement in the frequency range 200–800 Mc/s of the variation of attenuation with frequency for concentric-line filters. The results are in rough agreement with formulae derived from transmission-line theory, which is given in an appendix by R. F. Proctor & R. W. Sloane. It is shown that for most practical purposes the cut-off frequency can be calculated from simple lumped-circuit theory. Construction details for a number of low-pass and high-pass filters are given.

621.396.662.32.029.63 **1613**

An Ultra-High-Frequency Low-Pass Filter of Coaxial Construction.—C. L. Cuccia & H. R. Hegbar. (*RCA Rev.*, Dec. 1947, Vol. 8, No. 4, pp. 743–750.) Metal disks placed at equal intervals along the inner conductor of a coaxial line provide lumped capacitances which produce a multi-section constant-K T-type low-pass filter. Design equations are derived and applied to two coaxial filters whose cut-off frequencies are 800 and 1 800 Mc/s respectively.

621.396.69 **1614**

Present Status of Printed Circuit Technics.—A. F. Murray. (*Tele-Tech*, Dec. 1947, Vol. 6, No. 12, pp. 29–33.) Summaries of the following papers at a Washington symposium, 15th Oct. 1947. Printed Circuit Technics, by A. S. Khouri. Status, Applications and Limitations of PC [printed circuits], by C. Brunetti. Printed Vitreous Dielectric Units, by C. I. Bradford. Metal Films and Their Applications to Resistors and Printed Circuits, by J. W. Jira. Printed Resistors, by J. Marsten & A. L. Pugh, Jr. Printing Conductors on Glass, by H. S. Cramer. Physical Aspects of PC Conductors, by L. I. Marton. Conductor Paints, by W. V. Patton. Spraying Technic, by G. W. Johnson. Military Program Needs, by B. Blom. PC in Radio Receivers, by A. Gross. See also 1913 of 1947 (Sargrove).

GENERAL PHYSICS

530.145 **1615**

Report of a Series of Lectures given by P.A.M. Dirac on the Second Quantification.—M. Baranger & F. Netter. (*Rev. sci., Paris*, 1st/15th June 1947, Vol. 85, Nos. 3274/3275, pp. 623–632.)

535.1 : 530.12 **1616**

Notes on the New Theory of Light.—L. Bloch. (*J. Phys. Radium*, July 1945, Vol. 6, No. 7, pp. 196–202. In French.) The new theory of L. de Broglie is interpreted in a geometrical manner suggested by the principle of relativity, and applied to representations leading to an electromagnetism purely Maxwellian, with spin 1, and an electromagnetism purely non-Maxwellian, with spin 0. See "Nouvelle théorie de la lumière", by L. de Broglie (T. I. Herrmann et Cie, Paris, 1940).

535.12 **1617**

On the Diffusion of Spherical Waves in a Dispersive Medium.—M. Lévy. (*C. R. Acad. Sci., Paris*, 26th Jan. 1948, Vol. 226, No. 4, pp. 330–332.) Formulae for the partial and global damping factors are derived and briefly discussed.

535.42 **1618**

Huyghens' Principle and Diffraction.—J.P.Vasseur. (*C. R. Acad. Sci., Paris*, 15th March 1948, Vol. 226, No. 11, pp. 885–886.)

536.48 + 537.312.62 **1619**

Low-Temperature Physics in North America.—J. F. Allen. (*Nature, Lond.*, 29th Nov. 1947, Vol. 160, No. 4074, pp. 736–737.) A general account of a visit to low temperature laboratories in North America. A compact liquefier is described, suitable for any gas, including helium, in which all the cooling is obtained by the principle of external work. R.f. phenomena under examination are the properties of superconducting cavities for λ 1.25 cm, and the 'anomalous skin resistance' of metals at low temperatures. The rectifying properties of niobium carbide in the transition region near 15°K are being examined.

537.221 **1620**

On Frictional Electricity.—E. Darmois. (*C. R. Acad. Sci., Paris*, 15th March 1948, Vol. 226, No. 11, pp. 882–883.) A short discussion of various theories and experimental results.

537.226.1 : 621.317.3.011.5 **1621**

On the Interpretation of Pulse Measurements of the Dielectric Constant.—Letienne. (*See* 1671.)

537.291 : 621.385 : 621.317.329 **1622**

Electrolyte-Tank Study of Electron Beams, taking account of Space Charge.—Goudet & Musson-Genon. (*See* 1811.)

537.56 : 621.385 **1623**

Production of H.F. Energy by Ionized Gases in a Magnetic Field.—J. L. Steinberg. (*Rev. sci., Paris*, 1st/15th June 1947, Vol. 85, Nos. 3274/3275, pp. 601–606.) Results of observations on metre wavelengths. The noise is only produced when the magnetic field is present. At constant gas pressure the noise reaches a maximum value for a certain field and discharge current. Probe measurements show the noise to be greatest when the probe assumes the local potential. The effects seem to exhibit characteristics very different from those observed for longer waves. See also 715 of 1947 (Thonemann & King).

538.566 : 621.396.671 **1624**

On the Application of the Kirchhoff-Huyghens Principle to Electromagnetic Radiation Fields, with Examples.—H. Zuhrt. (*Frequenz*, Nov. & Dec. 1947, Vol. 1, Nos. 2 & 3, pp. 33–37 & 63–70 & Jan. 1948, Vol. 2, No. 1, pp. 6–12.) The use of simple formulae which are valid for scalar wave functions but not for e.m. field vectors leads to false results when calculating radiation fields. General formulae are derived for the cases of refraction and reflection; these are applied to determine the radiation from the open end of a rectangular waveguide and to calculate the horizontal and vertical polar diagrams of a paraboloid aerial.

621.39 **1625**

Bandwidth *vs* Noise in Communication Systems.—D.G.F. (*See* 1745.)

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.7 + 523.854] : 621.396.822 **1626**

Recent Research on Extra-Terrestrial Emission of Metre Waves.—J. Denisse. (*Rev. sci., Paris*, 1st May 1947, Vol. 85, No. 3272, pp. 483–488.) Discussion of the results obtained by various investigators of radiations from the sun and from the galaxy, and suggested explanations. See also 402 of 1947 (Appleton) and back references.

523.72 : 621.396.822 **1627**

Observation of Electromagnetic Radiation from the Sun.—Y. Rocard. (*Rev. sci., Paris*, 15th April 1947, Vol. 85, No. 3271, p. 422.) Direct reception on a radar receiver was effected in April 1947 on board a French naval vessel. The wavelength used cannot be disclosed. The received radiation was at first little above the background noise in the receiver, but increased very considerably in less than an hour. It appeared to consist of a succession of discharges analogous to those of lightning. The p.p.i. was quite confused by the parasitic signal over a considerable angular sector corresponding to the relatively low directivity of the aerial. The results are the first of their kind obtained in France.

523.72.029.3 : 621.396.822 **1628**

Audio-Frequency Radio Waves from the Sun.—D. H. Menzel & W. W. Salisbury. (*Nature, Lond.*, 17th Jan. 1948, Vol. 161, No. 4081, p. 91.) The existence of solar radiation in the frequency range 1–500 c/s could explain various observed effects in both the sun and the ionosphere. Using a large loop aerial and a tunable a.f. amplifier, variations of the right order of magnitude and of frequency up to about 400 c/s have been observed. Experiments to determine whether these variations are of solar or terrestrial origin are in progress.

523.74/.75 : 551.510.535 **1629**

On the Relations between Ionosphere, Sunspots and Solar Corona.—K. O. Kiepenheuer. (*Mon. Not. R. astr. Soc.*, 1946, Vol. 106, No. 6, pp. 515–524.)

523.745 : 550.385 **1630**

Solar Streams of Corpuscles and Their Relation to Geomagnetic Storms.—S. K. Chakrabarty. (*Mon. Not. R. astr. Soc.*, 1946, Vol. 106, No. 6, pp. 491–499.) The equation of the stream curves of such particles has been obtained as a function of the velocity of emission and the coordinates of the point of emission, generating the two-dimensional motion considered by Chapman. The results obtained show that a very narrow beam of corpuscles emitted from a point on the sun's surface can produce a magnetic storm of given duration provided the velocity of the emitted particles has a continuous distribution, the width of the velocity spectrum determining the duration of the storm. The velocity of emission of the corpuscles which are possibly responsible for the commencement of some 'very great' geomagnetic storms that have occurred in recent years has been calculated.

523.745 " 1946.07.25 " **1631**

Visual and Spectrographic Observations of a Great Solar Flare, 1946 July 25.—M. A. Ellison. (*Mon. Not. R. astr. Soc.*, 1946, Vol. 106, No. 6, pp. 500–508.)

1632

523.78 " 1947.05.20 " : 621.396.11 : 551.510.535

Provisional Results obtained by the French Mission to Brazil during the Total Solar Eclipse, 20th May 1947.—Y. Rocard. (*Rev. sci., Paris*, 1st/15th June 1947, Vol. 85, Nos. 3274/3275, p. 618.) The critical frequencies of the E, F_1 and F_2 layers show a partial return to night conditions during the eclipse. The absence of time lag indicates that ionization changes in these layers are not due to corpuscular rays, but solely to radiation effects. Calculated falls in ionization, relative to normal values, are: E layer, 64%; F_1 layer, 75%; F_2 layer, 30%. Propagation conditions for a frequency of 4 Mc/s show a return to night conditions at the centre of the eclipse. The D-layer absorption curve follows the eclipse with no phase lag and without asymmetry. See also 1640 below.

538.12 : 521.15 **1633**

Universal Constants in Blackett's Formula.—H. Y. Tzu. (*Nature, Lond.*, 29th Nov. 1947, Vol. 160, No. 4074, pp. 746–747.) "If we assume that the equations of the new theory can be derived from a Lagrangian, and that the magnetic moment of a rotating body is originated through some cross-terms between the gravitational and the electromagnetic field quantities in the Lagrangian, then it would be found that there must be other universal constants than G and c in the theory." Blackett's theory was noted in 3112 of 1947.

538.12 : 521.15 : 538.71 (24.084) **1634**

On the Mechano-Magnetic Effect inside Rotating Spherical Masses. Application to the Terrestrial Magnetic Field.—A. Gião. (*C. R. Acad. Sci., Paris,* 23rd Feb. 1948, Vol. 226, No. 8, pp. 645–647.) Formulae derived from the author's unitary theory of geomagnetism (1023 of April and back references) are used to calculate the earth's field at a depth of 1463 m. The result is in good agreement with measurements by Hales & Gough at this depth in a mine in the Transvaal (1635 below).

538.12 : 521.15 : 538.711 (24.084) **1635**

Blackett's Fundamental Theory of the Earth's Magnetic Field.—A. L. Hales & D. I. Gough. (*Nature, Lond.,* 29th Nov. 1947, Vol. 160, No. 4074, p. 746.) An account of a series of measurements made with a horizontal magnetometer (Schmidt type) at a mean depth of 4800 ft below the surface in the Witwatersrand mines. The field underground was less than that at the surface. Errors in the observations due to geological and other causes are discussed. Comparisons are made with theoretical predictions. Blackett's theory was noted in 3112 of 1947; see also 1634 above.

550.385 **1636**

Magnetic Storms.—S. Chapman. (*Rev. sci., Paris,* 15th April 1947, Vol. 85, No. 3271, pp. 387–400.) A lecture at the Henri Poincaré Institute, 24th March 1947, giving an account of the various phenomena observed and a detailed discussion of systems of earth currents which could explain these effects.

551.508.94 : 621.317.32 **1637**

Radiosonde Potential Gradient Measurements.—Belin. (*See* 1674.)

551.51 **1638**

On the Problem of Atmosphere Models where the Absorption Coefficient is an Arbitrary Function of Frequency.—V. Kourganoff. (*C. R. Acad. Sci., Paris,* 10th Dec. 1947, Vol. 225, No. 23, pp. 1124–1126.) An extension of the variational method is used to obtain a general solution for an atmosphere for which g, T_e and the chemical composition are known.

551.510.535 **1639**

Ionosphere Recorder.—(*Tele-Tech,* Dec. 1947, Vol. 6, No. 12, pp. 79–81.) The entire frequency range from 1 to 25 Mc/s is covered continuously without bandswitching by beating a fixed-frequency pulsed oscillator (30 Mc/s) and a variable frequency oscillator (31–55 Mc/s) in a low-level mixer. The difference frequency is amplified by a wide-band r.f. amplifier delivering several kilowatts peak power to a wide-band aerial. The receiver consists of a 30-Mc/s amplifier preceded by an untuned balanced mixer. Voltages from the transmitter variable oscillator are mixed with the received variable-frequency echoes to produce pulses of constant frequency. Presentation is similar to that of a normal radar-'A' scan, and is photographed continuously on 35-mm film. Continuous records on 16-mm film are also obtained of a derived radar-'B' scan having both frequency and height coordinates. See also 3518 of 1947 (Wells).

551.510.535 : 523.78 "1947.05.20" **1640**

Results of Ionosphere Observations during the Total Eclipse of the Sun, 20th May 1947.—J. F. Denisse, P. Seligmann & R. Gallet. (*C. R. Acad. Sci., Paris,* 10th Dec. 1947, Vol. 225, No. 23, pp. 1169–1171.) The observations were made at Bébédouro, Brazil. The critical frequencies and virtual heights of the E, E_s, F_1 and F_2 layers were determined every 4 minutes by automatic apparatus with a frequency sweep from 1.4 Mc/s to 18 Mc/s. D-layer absorption was measured on fixed frequencies. Curves are given showing the results obtained. A full discussion will be given later.

E layer: normal variation, leading to a value for the recombination coefficient of the order of $\alpha_E = 0.5 \times 10^{-8}$.

F_1 layer: hardly distinguishable from the F_2 layer. The sudden ionization drop in F_2 about 0900 affected the variation of F_1. Recombination coefficient, about $\alpha_{F_1} = 2 \times 10^{-9}$.

F_2 layer: sudden drop in ionization occurred about 50 min after the commencement of the optical eclipse. This time lag was not observed for the other layers; it may be connected with the occultation of a group of sunspots. Minimum value of recombination coefficient, $\alpha_{F_2} \geqslant 10^{-10}$.

D layer: measurements on 4 Mc/s showed an ionization variation in synchronism with the eclipse, leading at totality to night propagation conditions, with $\alpha_D > 10^{-7}$.

No particular variation was observed either of the E_s layer or of the apparent heights of the different layers. See also 1632 above.

551.557 : 621.396.11.018.41 **1641**

Influence of Wind on the Frequency of Radio Waves.—Jouaust. (*See* 1726.)

551.593.9 **1642**

The Origin of the Night Sky Light.—D. R. Bates. (*Mon. Not. R. astr. Soc.,* 1946, Vol. 106, No. 6, pp. 509–514.) Experimental evidence indicates that the light may be due partly to incident charged particles which, at low latitudes, are enabled by the action of the Störmer current to approach the earth.

551.593.9 : 523.72 **1643**

The Luminescence of the Night Sky and Corpuscular Solar Radiation.—A.I. Ol. (*Priroda,* 1947, No. 7, pp. 3–11. In Russian.) The role of the corpuscular radiation from the sun in the excitation of the night sky luminescence is discussed under the following headings; (*a*) methods for studying the night sky luminescence; (*b*) spectral analysis of luminescence; (*c*) excitation mechanism of luminescence; (*d*) regular variations of the night sky brightness, and (*e*) irregular variations of brightness. It is concluded that this phenomenon consists of a background luminescence on which irregular variations of brightness are superimposed. The background luminescence is due to the ultraviolet radiation from the sun while the irregular variations are caused by streams of charged particles emitted by the sun.

551.593.9 : 535.61-15 **1644**

Concerning Very Intense Infra-Red Radiation in the Light of the Night Sky.—R. Herman, L. Herman & J. Gauzit. (*J. Phys. Radium,* June 1945, Vol. 6, No. 6, pp. 182–183. In French.) Photographic records show the existence of an infra-red band of mean wavelength 1.04 μ.

550.384.3 **1645**

Description of the Earth's Main Magnetic Field and Its Secular Change, 1905–1945. [Book Review]—E. H. Vestine, L. Laporte, C. Cooper, I. Lange & W. C. Hendrix. Carnegie Institution, Washington, 532 pp., $2.50. (*Nature, Lond.*, 31st Jan. 1948, Vol. 161, No. 4083, pp. 160–161.) "This volume is unique in geomagnetic literature not only for the extent of the underlying data and the fullness of the reduction and representation of the data; it is the first to describe at all adequately the nature of the processes of reduction and representation, with examples of the actual working sheets of computations for a typical observing station . . . The volume is a worthy embodiment and memorial of the first quarter-century of the observing work of the Department of Terrestrial Magnetism."

LOCATION AND AIDS TO NAVIGATION

621.396.933 **1646**

The Decca Navigator.—A. V. J. Martin. (*Toute la Radio*, March/April 1948, Vol. 15, No. 124, pp. 100–105.) Basic principles and mode of operation.

621.396.933 **1647**

Teleran: Part 2 — First Experimental Installation.—D. H. Ewing, H. J. Schrader & R. W. K. Smith. (*RCA Rev.*, Dec. 1947, Vol. 8, No. 4, pp. 612–632.) Describes demonstration equipment and discusses the choice of television parameters, synchronizing equipment, the television transmitter, altitude coding, cameras and mixing, the landing display, the airborne transponder beacon and the airborne television receiver. Part 1: 3138 of 1947.

621.396.933 : 621.397.331.2 **1648**

The Storage Orthicon and Its Application to Teleran.—Forgue. (*See* 1780.)

MATERIALS AND SUBSIDIARY TECHNIQUES

535.37 **1649**

Luminescent Materials.—In 2795 of 1947, cancel the author's name as given, and substitute G. Szigeti.

535.37 **1650**

On the Growth of Photoluminescence of ZnS under Constant Excitation.—J. Saddy. (*C. R. Acad. Sci., Paris*, 15th March 1948, Vol. 226, No. 11, pp. 896–898.) Experimental results conform to an exponential law.

535.37 **1651**

The Influence of Infra-Red Rays on the Excitation of Luminescence of CaS-Pb Phosphors.—S. A. Popok & F. D. Klement. (*Zh. eksp. teor. Fiz.*, Oct. 1947, Vol. 17, No. 10, pp. 915–923. In Russian.)

535.371.07 : 621.385.832 **1652**

Testing Long-Persistence Screens.—J. C. Tellier & J. F. Fisher. (*Electronics*, Feb. 1948, Vol. 21, No. 2, pp. 126–130.) Description of a test set for measuring under various conditions the build-up, persistence, and steady values of light output from long-persistence screens for a wide variety of c.r. tubes. All static voltage and current characteristics can also be determined. See also 3921 of 1947 (Johnson & Hardy) and 1653 below.

535.371.07 : 621.385.832 **1653**

Performance Characteristics of Long-Persistence Cathode-Ray Tube Screens; Their Measurement and Control.—R. E. Johnson & A. E. Hardy. (*RCA Rev.*, Dec. 1947, Vol. 8, No. 4, pp. 660–681.) The requirements and characteristics of phosphor coatings are discussed. A laboratory system is described for pulse excitation of cascade-type coatings with blue light, evaluating their characteristics in finished tubes, and correlating the values with field performance. Averaged curves show the effect of layer thickness and exhaust-bake temperatures on screen characteristics. See also 3921 of 1947 (Johnson & Hardy) and 1652 above.

546.42/.431].264 **1654**

Study of the Structure and of the Thermal Decomposition of Mixed Carbonates of Strontium and Barium.—R. Faivre & G. Chaudron. (*C. R. Acad. Sci., Paris*, 19th Jan. 1948, Vol. 226, No. 3, pp. 249–251.) X-ray diffraction studies show that these carbonates are miscible in all proportions. Dissociation isotherms at 800°C are given for various mixtures.

546.78 + 546.84] : 621.385.1.032.3 **1655**

Designing Thoriated Tungsten Filaments.—H. J. Dailey. (*Electronics*, Jan. 1948, Vol. 21, No. 1, pp. 107–109.) Thoriated tungsten filaments have a higher resistance after carburization, when they have greater thermal-power emissivity than either pure tungsten filaments or uncarburized thoriated filaments. These properties can be balanced with proper control of thoriation and carburization, so that a carburized thoriated tungsten filament can be found with electrical characteristics similar to those of a given pure tungsten filament. Formulae derived for pure tungsten filaments can thus be extended to yield design data for carburized thoriated tungsten filaments.

546.815.221 : 537.311.3 **1656**

Physical Properties of Lead Sulphide.—Yu. A. Dunaev & Yu. P. Maslakovets. (*Zh. eksp. teor. Fiz.*, Oct. 1947, Vol. 17, No. 10, pp. 901–910. In Russian.) An experimental investigation. The main conclusions reached are: (*a*) PbS has a constant number of carriers from 2.15°K to 800–900°K. In this interval PbS behaves as a typical metal and variations of conductivity with temperature are due entirely to variations of mobility. (*b*) When the temperature is raised above 800°K, the concentration of carriers grows exponentially and PbS behaves like a semiconductor. (*c*) The carriers transferred into the upper zone are apparently not taken from the lower filled zone, since a comparison of the Hall effect data with measurements of conductivity does not indicate the appearance of a mixed conductivity.

Changes in physical dimensions of PbS samples with temperature were also investigated.

549.514.51 **1657**

Recent Progress in the Technique of Piezoelectric Substances.—M. Tournier. (*Onde élect.*, Dec. 1947, Vol. 27, No. 249, pp. 447–459.) For growing quartz crystals at École de Physique et de Chimie Industrielles, autoclaves of stainless steel, with a capacity of 500 cm^3, are used. The critical temperature is about 374°C and critical pressure 216 kg/cm^2. The increase of length of the crystals, which are started from seed crystals previously etched in HF, is about 2 mm in 5 days. Methods are also described for growing crystals of the Rochelle-salt type. Agitation of the mother liquor is necessary to avoid occlusions of liquid. Periodical reversal of the rotation of the crystals tends to avoid cloudiness. A rate of growth of 6 mm per day may be obtained. The possibility of producing large crystals by fusion is discussed. See also 1825 of 1947.

621.3(54) **1658**

Electrical Engineering Problems in the Tropics : Part 2.—R. Allan. (*Beama J.*, Jan. 1948, Vol. 55, No. 127, pp. 16–20.) Conclusion of 1378 of May. Difficulties due to salt-laden air, dust, rodents and insects are discussed and typical wiring systems used in India are briefly described. Recommendations are made regarding general design of plant and treatment of materials. Manufacturers' tests can only be regarded as satisfactory if carried out under extreme temperature and humidity conditions.

621.315.59 **1659**

Sintered Semiconductors.—H. H. Hausner. (*Electronics*, Jan. 1948, Vol. 21, No. 1, pp. 138..184.) Resistivity and temperature coefficient are dependent on particle size and sintering temperature. Mixtures of coarse copper and fine graphite particles have similar resistivity characteristics to those of fine copper and coarse graphite mixtures, so that particle contact resistance appears to be more important than particle resistance. Mixtures of 10-μ crystalline graphite and ZrO_2 show a wide divergence of resistivity and temperature coefficient, the latter being zero in the 100-Ω-cm region when the mixture contains 72% ZrO_2. Mixtures of fine and coarse crystalline graphite show some correlation between resistivity and temperature coefficient. A graph illustrates the dependence of resistivity on sintering temperature.

621.315.612.4.011.5 : 546.431.82 **1660**

The Dielectric Properties of Barium Titanate at High Frequencies.—N. S. Novosil'tsev & A. L. Khodakov. (*Zh. tekh. Fiz.*, 1947, Vol. 17, No. 6, pp. 651–656. In Russian.) Experiments were conducted at frequencies from 1.5 to 66 Mc/s. The temperature coefficient of the dielectric constant is independent of frequency and the Curie point remains at 80°C. Ceramic dielectrics made up of mixtures of different titanates were also investigated. Some theoretical conclusions are given.

621.315.616 **1661**

Resin Bonded Insulation.—(*Elect. Rev., Lond.*, 9th April 1948, Vol. 142, No. 3672, pp. 533–536.) A detailed account of the manufacture of paper and fabric insulating boards with synthetic-resin bonding, and some particulars of the preliminary testing of the component materials to ensure satisfactory electrical properties of the finished product.

621.318.2 **1662**

Magnetic Materials.—J. L. Salpeter. (*Philips tech. Commun., Aust.*, April–July 1947, Nos. 4–6, pp. 3–10, 3–11 & 3–11.) Essentially similar to a paper abstracted in 3935 of 1947.

621.318.22 **1663**

Permanent Magnet Alloys.—E. M. Underhill. (*Electronics*, Jan. 1948, Vol. 21, No. 1, pp. 122–123.) Magnetic, physical and mechanical data tabulated for over 40 different alloys, with brief remark on methods of manufacture.

669.3 **1664**

Copper and Copper Alloys.—E. Voce. (*Metallurgia, Manchr*, Dec. 1947 & Jan. 1948, Vol. 37, Nos. 218 & 219, pp. 80–84 & 141–145.) A survey of technical developments during 1947, with a bibliography of 115 papers.

679.5 **1665**

The British International Plastics Annual, 1947. [Book Review]—Croome Hill International, London, 460 pp., 63s. (*Beama J.*, Jan. 1948, Vol. 55, No. 127, pp. 33–34.) A new annual, covering the whole field of 'laboratory synthesized resins and products made therefrom'. An outstanding feature is the mass of data under the heading 'the properties of commercial plastics', giving fifty-four items of technical information and interest in relation to several hundred grades, each listed under its trade name.

MATHEMATICS

517.514 **1666**

Stationary Aleatory Functions of Many Variables.—A. Blanc-Lapierre & R. Fortet. (*Rev. sci., Paris*, 15th April 1947, Vol. 85, No. 3271, pp. 419–422.) The principal properties of such functions are established, using the method of linear filters previously applied to functions of a single variable (3505 of 1947). For simplification, functions of two variables are considered, the results obtained being valid for any finite number of variables.

518.5 **1667**

Automatic Integration of Linear Sixth-Order Differential Equations by means of Punched-Card Machines.—L. F. Hausman & M. Schwarzschild. (*Rev. sci. Instrum.*, Dec. 1947, Vol. 18, No. 12, pp. 877–883.) Differential equations are converted to difference equations which are solved automatically in steps by punched-card machines operated by relay networks. The final solution is obtained by repeated integration, the truncation error being computed each time and applied as a correction to the subsequent integration.

518.5 : 621.392 : 621.385.832 **1668**

Numeroscope for Cathode-Ray Printing.—Fuller. (*See* 1574.)

MEASUREMENTS AND TEST GEAR

531.76 : 681.11 **1669**

Watch Timer.—R. S. Mackay, Jr, & R. R. Soule. (*Electronics*, Feb. 1948, Vol. 21, No. 2, pp. 160..168.) A stroboscopic method for indicating in a few minutes whether a watch is running fast or slow. Most watches tick 5 times per second, and each tick operates a strobotron flash tube which illuminates a disk revolved by a synchronous motor at exactly five revolutions per second. Alternatively the strobotron flash tube may be triggered by the ticks from a chronometer, in which case two images of the disk will be seen, apparently revolving at slightly different speeds. The exact speed of revolution of the disk is not then important.

621.317.3 **1670**

Measurement of Electrical Quantities by means of Phase Displacements in A.C. Circuits.—W. Schaaffs. (*Frequenz*, Jan. 1948, Vol. 2, No. 1, pp. 22–27.) The method depends on the phase difference between current and applied voltage, and can be used for measuring changes of resistance, inductance or capacitance, as well as the sum, difference or mean of quantities which can be represented by these electrical quantities. Many different types of phase-shift circuit are discussed. A polar c.r.o. is used as indicator. A measurement accuracy of 1 part in 1 000 can be obtained.

621.317.3.011.5 : 537.226.1 **1671**

On the Interpretation of Pulse Measurements of the Dielectric Constant.—R. Letienne. (*C. R. Acad. Sci., Paris*, 2nd Feb. 1948, Vol. 226, No. 5, pp. 399–400.) Pulse measurements give a much lower value of the dielectric constant ϵ than that obtained when using a sinusoidal voltage. ϵ has practically the same value for pulse repetition frequencies of 120 and 1 100. The results are discussed in relation to Debye's theory.

621.317.31 : 621.383 **1672**

Measurement of Small Photoelectric Currents by a Pulse Method.—J. Baurand & R. Lambert. (*J. Phys. Radium*, July 1945, Vol. 6, No. 7, pp. 206–208. In French.) A galvanometer in series with a large capacitance is shunted on the load resistance of an electrometer valve, whose grid receives a pulse each time the galvanometer coil passes the equilibrium position. Theory of the method is given and the choice of suitable components is discussed. With the most sensitive galvanometer used, a voltage of about 20 μV could be measured.

621.317.31 : 621.385.5 **1673**

Measurement of Small Currents : Characteristics of Types 38, 954, and 959 as Reduced Grid Current Tubes.—C. E. Nielsen. (*Rev. sci. Instrum.*, Jan. 1947, Vol. 18, No. 1, pp. 18–31.) A detailed study of the three types and of their use for small-current measurement. Results are given showing the dependence of grid and anode currents on the applied potentials. Grid currents less than 10^{-15} A in the 959 valve were obtained, with stability comparable with that of special electrometer valves.

621.317.32 : 551.508.94 **1674**

Radiosonde Potential Gradient Measurements.—R. E. Belin. (*Electronics*, Jan. 1948, Vol. 21, No. 1, pp. 184..190.) Potential gradient inside and near cumulo-nimbus clouds is measured by obtaining a point discharge from two collectors, oriented in opposition, and using the resulting current to control the squegging frequency of a modified radiosonde. The frequency received by the ground station thus gives a measure of the electrostatic field. Atmospheric pressure is also measured by the sonde so that the potential gradient can be determined during flight.

621.317.32 : 621.396.81.029.63 **1675**

Field Tests for Citizens Band.—Samuelson. (*See* 1728.)

621.317.333 : 621.315.3 **1676**

New Testing Apparatus for Enamelled Wire.—R. Friza. (*Elektrotech. u. Maschinenb.*, Jan./Feb. 1948, Vol. 65, Nos. 1/2, pp. 14–17.) For wire diameters of 0.03–0.8 mm. The wire is drawn off the reel at 20 cm/s through a bath containing a 5% solution of common salt. Faults in the insulation with a leakage resistance below 10 kΩ operate a relay and indicator lamp. Wire length is measured by the revolutions of one of the guide pulleys, which has a circumference of 10 cm.

621.317.336 + 621.317.341] : 621.392 **1677**

Method of measuring Feeder Parameters.—V. M. Kaganovich. (*Radiotekhnika, Moscow*, April 1947, Vol. 2, No. 4, pp. 62–67. In Russian, with English summary.) Describes measurement of attenuation with a standing-wave indicator and discusses briefly methods for measuring feeder impedance.

621.317.336 : 621.396.67 **1678**

Measurement of the Impedance of an Aerial.—P. Mourmant. (*Radio franç.*, Feb. 1948, pp. 4–8.) Methods described include (*a*) series or parallel resonance, (*b*) *Q*-meter, (*c*) simple bridge and (*d*) double-T bridge. Graphical presentation of the results is discussed.

621.317.34 : 621.396.822 **1679**

An Absolute Method of Measurement of Receiver Noise Factor.—Ullrich & Rogers. (*See* 1743.)

621.317.361 + 621.317.372 **1680**

New U.H.F. Methods for Measurement of Frequency and of Q.—R. Musson-Genon. (*Onde élect.*, Dec. 1947, Vol. 27, No. 249, pp. 461–469.) A cavity-resonator, a wavemeter, a f.m. oscillator and a c.r.o. are used for accurate comparison and measurement of frequencies. The period of the horizontal sweep of the sawtooth wave is suitably related to the modulation frequency. Accuracy is of the order of 1 part in 10^7. The method described can also be used for measurements of *Q*, from a few hundreds up to about 10 000, with an accuracy of a few per cent. It can also be used to determine the bandwidth of a f.m. oscillator.

621.317.361 **1681**

Measuring Instantaneous Frequency of an F.M. Oscillator.—L. E. Hunt. (*Tele-Tech*, Dec. 1947, Vol. 6, No. 12, pp. 34–35.) The frequency is compared with a calibrated c.w. signal by switching the two signals alternately into a f.m. detector and observing the oscilloscope pattern produced.

621.317.361 : 621.396.11 : 551.510.535 **1682**

The Effect of Doppler's Principle on the Comparison of Standard Frequencies over a Transatlantic Radio Path.—Booth & Gregory. (*See* 1723.)

621.317.373 **1683**

Standard Lag Line for Phase Measurement.—O. H. Schuck. (*J. acoust. Soc. Amer.*, Jan. 1948, Vol. 20, No. 1, pp. 26–39.) The available methods for electrical phase measurement are reviewed ; a method using a standard delay line as a reference is recommended. Such lines can be used for various types of measurements. The construction of two particular lines is described for measurements in the range 10–80 kc/s and a method of calibration is outlined. Accuracy within ¼° can be attained.

621.317.72 : 621.396.81 **1684**

A Pulse Field-Strength Measuring Set for Very High Frequencies.—B. G. Pressey & G. E. Ashwell. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 8, pp. 1359–1366.) Portable equipment for use on pulse or c.w. signals in the frequency bands 20–30 Mc/s and 40–650 Mc/s. It consists essentially of a receiver, including calibrated signal- and intermediate-frequency attenuators and output meter, and a c.r. output-indicator unit. The field strength is measured by adjustment of the attenuators for a standard output, which for pulse signals is read on the c.r. tube and for c.w. signals on the meter. A $\lambda/2$ dipole aerial is used, and the initial calibration of the standard output in terms of the field strength at the aerial is carried out by a radiation method. The minimum measurable field strength varies with frequency between 3 and 500 μV/m on short-pulse signals ($<2\mu$s), and between 1.5 and 250 μV/m on long-pulse and c.w. signals. The accuracy of relative measurements on any one frequency is within ± 0.5 db, and that of absolute measurements is within ± 2 db. Within these limits of accuracy the measurements are independent of pulse width when this is greater than 0.5 μs. Various types of measurement which have been made with the equipment are described, and they illustrate its wide range of application. Summary in *J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, pp. 228–229.

621.317.72.029.63/.64 : 621.396.81 **1685**

A Radio Field-Strength Measuring Set for use in the Frequency Range 400 to 4 000 Mc/s.—A. C. Grace. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 8, pp. 1325–1326.) The mixing unit, with its local oscillator of range 400–800 Mc/s, is used with a wide-band i.f. amplifier covering the range 0.5–3.5 Mc/s. Signals on frequencies above 800 Mc/s can be received with the aid of harmonics of the local oscillator. The equipment is normally supplied by batteries and can be used with several types of aerial.

621.317.725 + 621.317.734 **1686**

New Voltohmmeter.—F. Haas. (*Toute la Radio*, Jan. 1948, Vol. 15, No. 122, pp. 44–47.) The design is given of an instrument, with diode probe, which uses only components easily obtainable in France. Six ranges for both volts and ohms, with linear voltage scale and maxima of 1 V to 300 V. Maximum resistance range 3 MΩ.

621.317.725 **1687**

A Pocket V.T.V.M. [vacuum-tube voltmeter].—R. P. Turner. (*Radio News*, Nov. 1947, Vol. 38, No. 5, pp. 64–66..114.) For measuring d.c. voltages in four ranges 0–0.8–8–80–800 V. Input resistance on all ranges is 10 MΩ.

621.317.726 **1688**

The Measurement of Large Pulse Voltages at 200 Mc/s.—A. L. Cullen. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 8, pp. 1311–1314.) For pulse voltages up to 10 kV r.m.s. Accuracy is about 5%. A calculable fraction of the peak voltage is derived from the standing wave on a short-circuited line and measured with a valve peak-voltmeter. Possible sources of error are discussed and their magnitude is estimated.

621.317.74 : 621.315.21 **1689**

The Measurement of the Propagation Constants of Screened Twin Cables.—L. Essen. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 8, pp. 1319–1324.) Balanced-line measurements of propagation constants, at frequencies of 200 Mc/s and above, are discussed. In these measurements, errors due to unbalance of the cable can be eliminated, but the unbalance cannot be measured quantitatively. A method of measuring unbalance treats the cable as three unbalanced systems, which are measured separately on an unbalanced coaxial-line measuring equipment. Propagation constants of a number of commercial cables obtained by this method are tabulated ; they show good agreement with theoretical values and with balanced measuring-line results. A test procedure for examination of the balance of twin cables is described.

621.317.755 **1690**

The Design of High-Speed Oscillographs.—J. G. Bartlett & G. T. Davies. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 8, pp. 1304–1310.) Design difficulties are considered. The characteristics required in the timebase generator, the c.r. tube and the signal input circuits are discussed. " The limitations of present instruments at the very highest writing speeds are enumerated, and possible remedies are suggested."

621.317.763.029.62/.63 **1691**

An Absorption Wavemeter for 250-850 Mc/s.—R. G. Hibberd. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 8, p. 1303.) A wavemeter, using a butterfly tuning circuit and a crystal rectifier, is described and illustrated. Performance figures are given. Accuracy is between 1% and 2%.

621.317.763.029.62/.63 **1692**

Note on an Absorption Wavemeter to cover the Frequency Range 120-500 Mc/s.—M. C. Crowley-Milling. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 8, p. 1327.) " A sensitive, wide-range wavemeter, using a capacitance-loaded coaxial line as the resonator. The concentric line has a sliding central conductor, which serves to vary simultaneously the length of the line and the capacitance loading. The electrodes of the capacitor are so shaped as to produce an almost linear relationship between the position of the central conductor and the resonant frequency of the wavemeter. A crystal detector and galvanometer are used to indicate resonance."

621.317.79 : 621.385.2 : 621.396.822 **1693**

A Diode Noise Generator.—J. Moffatt. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 8, pp. 1335–1337.) The generator was designed as a standard source for the measurement of the noise factor of i.f. amplifiers of centimetre-wave receivers ; it has special output arrangements. The determination of the noise factor involves only the measurement of the d.c. diode current for specified output conditions. Summary in *J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, p. 228.

621.317.79 : 621.396.61 **1694**

F.M. Transmitter Performance Measurements.—H. P. Thomas & L. M. Leeds. (*Electronics*, Feb. 1948, Vol. 21, No. 2, pp. 84–87.) Discussion of the use of standard test equipment to ensure that frequency response, harmonic distortion and a.m. and f.m. noise are within the limits specified by the F.C.C.

621.317.79 : 621.396.615 **1695**

An Alignment Signal Generator for 5-35 Mc/s and 38-82 Mc/s, incorporating a Display System.—C. M. Burrell, W. R. Savery & P. B. F. Evans. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 8, pp. 1352–1358.) An account of the design and performance of an instrument for showing on a c.r.o. the frequency-response curve of an amplifier. The accuracy of representation is ± 0.2 to ± 0.3 db in amplitude and ± 200 kc/s in frequency. Any bandwidth between 1 Mc/s and the full extent of either band can be displayed. Summary in *J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, pp. 219–220.

621.317.79 : 621.396.615 **1696**

Universal Generator with Fixed Carrier Frequencies.—G. Nissen. (*Toute la Radio*, March/April 1948, Vol. 15, No. 124, pp. 116–119.) A generator suitable for receiver testing. It includes three h.f. oscillators f_1, f_2, f_3, an a.f. oscillator giving frequencies of 150, 400, 800 or 3000 c/s, and various capacitive attenuators. The circuit arrangements are such that for each of five h.f. ranges, three signals can be obtained simultaneously, modulated or not, and with voltages between 50 mV and 5 V for each of the 15 frequencies available. The main attenuator, of the capacitive type, is of unique design and produces no frequency shift. A small variable capacitor enables the frequency of f_2 to be varied by 2%.

621.317.79 : 621.396.615.14 **1697**

A Pulse-Modulated Signal Generator for 260-800 Mc/s.—R. G. Hibberd, J. H. Shankland & A. Bruce. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 8, pp. 1331–1334.) The design of a signal generator consisting of independent r.f. oscillator and pulse generator units is discussed in detail with circuit diagrams. Pulse lengths from ½ to 8 μs are available at repetition rates from 25 c/s to 25 kc/s. The oscillator frequency can be adjusted within ± 1%. The output attenuation range is 130 db. Summary in *J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, pp. 222–223.

621.317.79 : 621.396.615.14 **1698**

A Wide-Band Visual-Alignment Signal Generator for 10-100 Mc/s.—R. G. Hibberd. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 8, pp. 1328–1330.) Details of a signal generator with f.m. to a maximum of ± 20 Mc/s. It is used with an oscillograph to display the frequency response and sensitivity of amplifiers with bandwidths to about 30 Mc/s. Summary in *J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, p. 221.

621.317.79 : 621.396.615.14 : 621.396.619.16 **1699**

Methods of Pulse Modulation of Signal Generators covering 5-300 Mc/s.—E. D. Hart. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 8, pp. 1315–1318.) An account of war-time methods of applying pulses of duration 1–10 μs to wide-frequency-range signal generators, with a critical examination of defects. An improved gating method, using a grounded-grid triode, is described, giving a possible modulation depth of 99.5% with 0.25-μs delay. Suggestions for further improvements are outlined. Summary in *J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, pp. 220–221.

621.317.79 : 621.396.62.001.4 **1700**

Pocket Stethoscope.—R. L. Farnsworth. (*Radio News*, Nov. 1947, Vol. 38, No. 5, pp. 62–63.) A mains-operated unit, consisting of a probe and amplifier with aural and visual outputs, designed for fault tracing in radio and electronic equipment.

621.317.79 : 621.396.82 **1701**

Interference Measurement.—G. L. Hamburger. (*Wireless Engr*, Feb. & March 1948, Vol. 25, Nos. 293 & 294, pp. 44–54 & 89–97.) An examination of the effects of bandwidth on various types of interference, such as fluctuation noise, single and repeated impulses, and noise generated by d.c. motors. A special amplifier was constructed for operation at a fixed mid-band frequency of 5 Mc/s. Variation of bandwidth was effected by interchangeable filter sets. Circuit details are given. Measurements of fluctuation noise show that the effect of bandwidth follows the expected square-root law and that the diode rectifier does indicate the r.m.s. value of this type of noise. The amplifier response to transients was investigated by an oscillographic method. The response of four coupled band-pass filters differs in some respects from that of an idealized filter but agrees fairly well with theory. The relative shape of the transient envelope is independent of bandwidth and the crest values of the actual transients agree with those of the ideal transients within ± 3 db. In the case of repeated impulses, the narrower the bandwidth and the higher the recurrence frequency, the closer does the reading of the output meter approach the crest values of the transients. Motor noise follows the square-root law within the range investigated.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

531.717.1 : 534.321.9 **1702**

Portable Ultrasonic Thickness Gage.—N. G. Branson. (*Electronics*, Jan. 1948, Vol. 21, No. 1, pp. 88–91.) Circuit and operation details are given. The physical and electronic principles are discussed. Accuracy within 1% is claimed for uniform thicknesses, while accuracy within 2–5% may be expected for corroded materials.

531.767 : 629.135 **1703**

Precise Measurement of Aircraft Speed.—C. S. Franklin. (*Electronics*, Feb. 1948, Vol. 21, No. 2, pp. 72–77.) An American Army Air Force system for measuring true air-speed. Two modified instrument-landing-system beams are produced in parallel vertical planes ten miles apart. The aeroplane flies at right angles to these planes at any altitude; an airborne transmitter automatically sends a signal to a ground receiver and electronic chronograph as the aircraft passes through each beam. Great care is taken in setting up the aerial arrays to ensure that the beams are in vertical and parallel planes. A monitor receiver is located in each of these planes 400 ft from the transmitter;

small errors of course are thus automatically allowed for. The beams are aligned and maintained to within ± 50 ft, so that the maximum error for a speed of 600 m.p.h. is about $\frac{1}{3}$%.

534.321.9 : [616.314 + 669 **1704**

Ultrasonics in Solids.—S. Y. White. (*Audio Engng, N.Y.*, Oct. 1947, Vol. 31, No. 9, pp. 22–24 . . 42.) Discusses the application of ultrasonics to dentistry and metallurgy.

539.16.08 **1705**

A New Scale-of-Ten Recorder.—R. D. Lowde. (*J. sci. Instrum.*, Dec. 1947, Vol. 24, No. 12, pp. 322–324.) The instrument is compact and inexpensive. "Its operation is best described as that of scaling by $2(2^2 + 1)$, pentode flip-flop scale-of-two pairs being used throughout." Provision is made in the output stage for a recorder resolving time of 0.05 sec; the statistical loss for random counting is then 1% at an average rate of 4 000 counts/min. The model will function satisfactorily with a regular pulse input up to 100 kc/s.

539.16.08 **1706**

A One-Shot Multivibrator Anticoincidence and Recording Circuit.—S. J. du Toit. (*Rev. sci. Instrum.*, Jan. 1947, Vol. 18, No. 1, pp. 31–35.) A circuit using two one-shot multivibrators, for experiments where large numbers of counter tubes are to be used in anticoincidence.

539.16.08 **1707**

Some Photoelectric Thresholds for Geiger-Müller Counters with Evaporated Cathodes.—C. A. Ramm. (*J. sci. Instrum.*, Dec. 1947, Vol. 24, No. 12, pp. 320–321.) The thresholds were measured for several cathode metals, of which gold appears to be the best.

539.16.08 **1708**

Analysis of the Impulses from Geiger-Müller Tubes.—S. C. Curran & E. R. Rae. (*Rev. sci. Instrum.*, Dec. 1947, Vol. 18, No. 12, pp. 871–876.) The method of analysis described is suitable for finding the effective dead-time of high-resolving-power counters. Spurious pulses from positive ions incident on the cathode are revealed and the drift time of the ions can be measured. Results are given for tubes containing various diatomic gases and methane, mixed with alcohol. Tubes containing such mixtures are inefficient for β-ray detection.

615.83 : 534.321.9 **1709**

Ultrasonic Treatment, a New Branch of Physical Therapy.—G. Fiedler. (*Frequenz*, Nov. 1947, Vol. 1, No. 2, pp. 56–59.) A short review of the first technical and biological applications, with a discussion of therapeutic effects, especially in cases of sciatica, neuralgia and cancer. The Siemens-Reiniger equipment, with an output in water of 40 W at 800 kc/s, is briefly described.

621.383.001.8 : 535.61-15 **1710**

An Infra-Red Image-Converter Tube.—T. H. Pratt. (*J. sci. Instrum.*, Dec. 1947, Vol. 24, No. 12, pp. 312–314.) The basic design consists of an Ag-Cs_2O photocathode deposited on a plane glass surface with an anode in the form of a willemite screen parallel to it. Infra-red radiation falling on the cathode releases electrons, which are accelerated to the anode, where they form a fluorescent image corresponding to the initial infra-red image. Possible applications are indicated. See also 2861 of 1947 (Morton & Flory).

621.384.6 **1711**

The Path towards Milliards of Electron-Volts.—B. Kwal. (*Toute la Radio*, Jan. 1948, Vol. 15, No. 122, pp. 48–53.) A discussion of the principles and special features of various types of electron accelerators, including e.s. generators of the Van de Graaff type, the betatron, cyclotron, synchrotron and linear accelerators.

621.384.6 **1712**

R.F. System for Frequency Modulated Cyclotron.—K. R. MacKenzie & V. B. Waithman. (*Rev. sci. Instrum.*, Dec. 1947, Vol. 18, No. 12, pp. 900–907.) A grounded-grid f.m. oscillator and single-dee resonator system are described and coupling constants, phase correction, a.m. and discharge phenomena are discussed.

621.385.833 **1713**

Progress in Electron Microscopy.—R. Reed. (*Nature, Lond.*, 29th Nov. 1947, Vol. 160, No. 4074, pp. 762–763.) An account of a conference of the Electron Microscopy Group of the Institute of Physics, held at Leeds in September, 1947.

621.385.833 : 523.821.5 **1714**

Use of Electronic Telescope in Stellar Photometry.—A. Lallemand & F. Lenouvel. (*C. R. Acad. Sci., Paris*, 10th Dec. 1947, Vol. 225, No. 23, pp. 1129–1130.) The apparatus used consists of a semi-transparent photocathode whose spectral sensitivity extends to 1.2 μ; an e.s. lens reproduces the electronic image of the photocathode on a fluorescent screen. The image of an artificial star is projected on to the photocathode beside that of the star under observation and adjusted to obtain intensity equality on the fluorescent screen.

621.386 **1715**

One-Millionth Second Radiography and Its Development.—C. M. Slack & L. F. Ehrke. (*ASTM Bull.*, Jan. 1948, No. 150, pp. 59–68.) An account of the development of X-ray tubes with electron currents of 1 000–2 000 A, also of surge generators capable of giving such currents under pulse conditions. Typical applications are described.

621.396.621.54.001.8 **1716**

Superregenerative Circuit Applications.—Stockman. (*See* 1591.)

621.397.331.2 : 551.462 **1717**

Underwater Television.—Engleman. (*See* 1779.)

621.398 + 621.317.083.7] : 627.8 **1718**

Radio Control for Water Works.—(*Electronics*, Jan. 1948, Vol. 21, No. 1, pp. 152 . . 158.) A radio system of telephony, telemetry and telecontrol providing intercommunication between the pump station, the reservoir, and the water company's office.

PROPAGATION OF WAVES

538.566 + 621.396.11 **1719**

Guided Propagation in Metal Tubes and in the Atmosphere.—J. Voge. (*Onde élect.*, Jan. 1948, Vol. 28, No. 250, pp. 29–38.) A ray method is described for the study of guided waves; it is applicable to homogeneous dielectrics or to those whose heterogeneities are small compared with λ. Both phase and amplitude of the waves can easily be found. The method is applied to metal waveguides and to the anomalous propagation of very short waves in atmospheric ducts. In both cases a certain number of proper waves can be guided. The cut-off wavelength, the group and phase velocities, and the vertical distribution of the field are calculated. In the case of the atmospheric duct, the method fails in the neighbourhood of the caustic and in the diffraction zone, but here the optical methods developed by Fresnel and Airy and based on Huyghens' principle can be applied. It is found that only the rays of very small inclination to the horizon can be guided in the actual atmosphere. Consequently the maximum wavelength which can be so guided is very much less than the height of the duct, and the phase and group velocities approximate to that of light in vacuo.

538.566 **1720**

Some Theorems on Group Velocities of Electromagnetic Waves.—S. M. Rytov. (*Zh. eksp. teor. Fiz.*, Oct. 1947, Vol. 17, No. 10, pp. 930–936. In Russian.)

621.396.11 **1721**

Russian Radiophysics and the Theory of Radio Wave Propagation over the Surface of the Earth.—E. L. Feinberg. (*Radiotekhnika, Moscow*, April 1947, Vol. 2, No. 4, pp. 5–14. In Russian, with English summary.) The researches of Russian investigators are outlined.

1722

621.396.11 : 523.78 " 1947.05.20 " : 551.510.535

Provisional Results obtained by the French Mission to Brazil during the Total Solar Eclipse, 20th May 1947.—Rocard. (*See* 1632.)

621.396.11 : 621.317.361 : 551.510.535 **1723**

The Effect of Doppler's Principle on the Comparison of Standard Frequencies over a Transatlantic Radio Path.—C. F. Booth & G. Gregory. (*P.O. elect. Engrs' J.*, Jan. 1948, Vol. 40, Part 4, pp. 153–158.) An account of the calibration of an oscillator incorporated in the Post Office standard of frequency at Dollis Hill, and of its use for frequency comparisons with the National Bureau of Standards' standard frequency transmissions from Washington on 10 Mc/s and 15 Mc/s. Apparent frequency changes of up to approximately ± 25 parts in 10^8, due to the Doppler effect, were found in the received signals. See also 3254 of 1947 and 1725 below.

621.396.11 : 621.396.5 **1724**

Transoceanic Radiotelephony.—Guldimann. (*See* 1750.)

621.396.11.018.41 **1725**

Modification of the Frequency of Radio Waves during Propagation.—B. Decaux. (*C. R. Acad. Sci., Paris*, 26th Jan. 1948, Vol. 226, No. 4, pp. 328–329.) Measurements of the frequency of the standard transmissions from Washington were made with special apparatus permitting observation of frequency differences of 0.02 c/s. The results show that the phase instability is more pronounced for the lower transmission frequencies. A diurnal variation of the received frequency has been observed, the morning value being, with few exceptions, higher than the evening value. The frequency variation is of the order of 6×10^{-8} and in certain cases may exceed 20×10^{-8}. Differences are also found between the measurements on the various transmission frequencies; such differences may be as much as 25×10^{-8}, though the same frequency reference standard is used for all measurements. In general the relative frequency variation of the morning transmission on 5 Mc/s is distinctly higher than for the other transmissions, the average difference from 22nd December to 15th January being 8×10^{-8}. Measurements every hour between 0630 and 2230 on any frequency show a fairly sharp maximum towards 0800 and a flat minimum between 1330 and 2100, the difference between maximum and minimum being about 15×10^{-8}. See also 1723 above and 1726 below.

621.396.11.018.41 : 551.557 **1726**

Influence of Wind on the Frequency of Radio Waves.—R. Jouaust. (*C. R. Acad. Sci., Paris*, 26th Jan. 1948, Vol. 226, No. 4, pp. 329–330.) It is suggested that the results obtained by Decaux (1725 above) may be due to ionospheric winds which give rise to a Doppler effect. See also 3254 of 1947 (Griffiths).

621.396.11.029.6 **1727**

Propagation of Very Short Waves.—D. E. Kerr. (*Electronics*, Jan. & Feb. 1948, Vol. 21, Nos. 1 & 2, pp. 124–128 & 118–123.) A simplified presentation of the immense mass of new theory and data dealing with factors governing propagation at frequencies between 100 and 30 000 Mc/s. Both one-way and two-way transmission are considered, and the effects of earth curvature, surface reflections, and atmospheric refraction are discussed in detail.

621.396.81.029.63 : 621.317.32 **1728**

Field Tests for Citizens Band.—R. E. Samuelson. (*Electronics*, Jan. 1948, Vol. 21, No. 1, pp. 92–96.) An explanation of an empirical equation which indicates the coverage to be expected for two-way systems in the 465-Mc/s band. Some details are given of the test equipment used and of its capabilities. See also 802 of March (Bullington) and 855 of March (Hollis).

RECEPTION

621.396/.397].62 **1729**

A Complete Television Receiver.—(*Télévis. franç.*, Jan. 1948, No. 33, pp. 20–23.) Full circuit and coil winding details of a receiver with provision for radio reception on long and medium waves and on 6 short-wave bands.

621.396.621 **1730**

Concerning an Invention.—R. Aschen. (*Télévis. franç.*, Jan. 1948, No. 33, Supplement *Électronique*, pp. 30–31.) Discusses various applications of a system of reception in which the frequency of a local oscillator is varied periodically about a mean frequency equal to the signal frequency. Such a system introduces a certain amount of distortion, but has the advantage of simplifying receiver design and reducing the number of stages required. Applications to the reception of c.w., R/T, and television transmissions, and to a l.f. harmonic analyser, are mentioned.

621.396.621 **1731**
Hazeltine FreModyne F.M. Circuit.—(*Tele-Tech*, Dec. 1947, Vol. 6, No. 12, pp. 41 . . 86.) Combines superheterodyne and superregenerative principles and gives good selectivity and a.f. output.

621.396.621 : 621.314.2 **1732**
Intermediate Frequency Transformers for A.M.-F.M. Receivers.—E. G. Beard. (*Philips tech. Commun., Aust.*, Nov. 1946, No. 6, pp. 12–15.) Circuit arrangements are discussed and simple a.m./f.m. switching arrangements described.

621.396.621 : 621.396.619.11 **1733**
The Synchrodyne : Refinements and Extensions.—D. G. Tucker & J. Garlick. (*Electronic Engng*, Feb. 1948, Vol. 20, No. 240, pp. 49–54.) A method is suggested for stabilizing the phase difference between the output and input signal of the synchronized oscillator. The synchronizing signal can thus be substantially reduced in level, so that interfering signals in the output of the synchronized oscillator become very small.

The synchrodyne can also be used as a rejector instead of as an acceptor by arranging that the phase angle between the local oscillator output and the carrier of the signal fed to the demodulator is 90° instead of zero. By using an additional synchrodyne circuit, tuned to reject the unwanted signal, it would therefore be possible to receive a weak station adjacent to a strong one, even when the sidebands overlap.

Other suggestions include the application of the synchrodyne circuit to short-wave receivers, to the reception of i.c.w. signals, and to single-span frequency coverage. See also 1139 of April and back references.

621.396.621 : 621.396.619.13 **1734**
A Narrow-Band F.M. Adapter.—B. DuHart. (*Radio News*, Nov. 1947, Vol. 38, No. 5, pp. 46 . . 128.) A simple limiter and discriminator unit which can be used to adapt any type of communications receiver to detect narrow-band f.m. signals. An ordinary untapped i.f. transformer is used in the discriminator circuit.

621.396.621 : 621.396.672 **1735**
Capacity Aerials for Mains Receivers.—(*See* 1563.)

621.396.621.53.029.62 **1736**
28-54 Mc/s Converter, incorporating RL37 Grounded Grid R.F. Amplifier with ECH35 Mixer.—D. B. Knock. (*Philips tech. Commun., Aust.*, Oct. 1947, No. 9, pp. 3–5.) Circuit details of a converter for amateur v.h.f. communication.

621.396.621.54 **1737**
Superregenerative Reception of Pulse Signals.—M. K. Belkin. (*Radiotekhnika, Moscow*, March 1947, Vol. 2, No. 3, pp. 47–62. In Russian, with English summary.) The conditions for maximum amplification are found by solving linear differential equations derived for all possible phase relations.

621.396.621.54 : 621.396.82 **1738**
Effect of Interference on a Superregenerator : Part 2 — Effect of Fluctuation Interference.—L. S. Gutkin. (*Radiotekhnika, Moscow*, April 1947, Vol. 2, No. 4, pp. 24–45. In Russian, with English summary.) The effective noise voltages at the output of the superregenerative circuit and at that of the narrow-band filter in series with the detector are determined. The signal/noise ratio for a superregenerative receiver is shown to be higher than for an ordinary receiver by a factor which increases with the degree of superregeneration and may reach a value of about 2. Part 1 : *ibid.*, 1946, Vol. 1, No. 9.

621.396.81 : 621.396.96 **1739**
Signal-Noise Ratio in Radar.—S. de Walden. (*Wireless Engr*, March 1948, Vol. 25, No. 294, pp. 97–98.) Criticism of 1146 of April (Levy).

621.396.82 : 621.317.79 **1740**
Interference Measurement.—Hamburger. (*See* 1701.)

621.396.822 **1741**
Survey of Radio Noise.—(*Nature, Lond.*, 17th Jan. 1948, Vol. 161, No. 4081, p. 107.) See 534 of February.

621.396.822 : 538.523 **1742**
Electromagnetic Background Noise due to Sea Waves.—Y. Rocard. (*Rev. sci., Paris*, 1st May 1947, Vol. 85, No. 3272, p. 481.) See 251 of January.

621.396.822 : 621.317.34 **1743**
An Absolute Method of Measurement of Receiver Noise Factor.—E. H. Ullrich & D. C. Rogers. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 8, pp. 1347–1351.) " This factor is the ratio of the signal/noise ratio in a resistive source at room temperature before connection to the receiver, to that existing in the receiver output. It is assumed that the noise in the source is thermal, i.e. that no extraneous noise pick-up is present.

" The measurement is made by using a dummy aerial as a source, and raising its temperature until a measurable increase in noise output is obtained. The noise factor can then be deduced from the increase in noise output and the temperature of the dummy aerial. The method has been used at frequencies up to 1 200 Mc/s. The paper includes some practical details of measurement, and experimental results obtained at frequencies of 45, 200 and 600 Mc/s." Summary in *J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, pp. 233–234.

621.396.823 **1744**
Radio Interference Tests on an Electrified Railway.—S. F. Pearce. (*Beama J.*, Jan. 1948, Vol. 55, No. 127, pp. 13–14.) Tests at various distances from the track show that interference falls off approximately as $(\text{distance})^{-2}$ and is unlikely to disturb broadcasting reception.

STATIONS AND COMMUNICATION SYSTEMS

621.39 **1745**
Bandwidth *vs* Noise in Communication Systems.—D.G.F. (*Electronics*, Jan. 1948, Vol. 21, No. 1, pp. 72–75.) A report on an I.R.E. symposium at which the law

$$C = W \log_2[1 + (P/N)]$$

was proposed, where C is the capacity of the channel, or number of binary digits which can be transmitted in unit time, W is the bandwidth of the channel and P/N is the signal/noise ratio in power units. This formula extends the Hartley law, which states that C/W is constant.

Using mathematical-physical concepts of quantum mechanics, the derivation of the proposed law is discussed for an ideal system. Pulse code modulation, unlike earlier systems of modulation, takes full advantage of the theoretical possibilities. See also 1057 of 1947 (Gabor) and 1491 of May.

621.39.015.3 : 621.317.35 **1746**

Telecommunication System in Transient State.—D. C. Espley. (*Onde élect.*, Dec. 1947, Vol. 27, No. 249, pp. 437–446.) A discussion with special reference to the waveform of the signals during passage through the system. The point of view is physical rather than mathematical; by reference to the relation between frequency and time it is found possible to design practical circuits, including time equalizers and phase compensators, without recourse to frequency/attenuation and frequency/dephasing characteristics.

621.396.1 **1747**

Frequency Allocations.—P. F. Siling. (*RCA Rev.*, Dec. 1947, Vol. 8, No. 4, pp. 737–742.) A general review, with particular reference to the Atlantic City conference and to the R.C.A. charts now being distributed.

621.396.1 **1748**

Radiocommunication Conference at Atlantic City.—B. de Clejoulx. (*Onde élect.*, Jan. 1948, Vol. 28, No. 250, pp. 13–28.) An account of the principal results of the conference, including definitions, classification and quality of transmissions, frequency allocations, conditions for mobile stations, International Frequency Registration Board (IFRB), new list of frequencies, marine and aeronautical services, and reorganization of the CCIR.

621.396.1 **1749**

International Telecommunications Conferences, Atlantic City, 1947.—A.H.M. (*P.O. elect. Engrs' J.*, Jan. 1948, Vol. 40, Part 4, pp. 175–178.) A critical discussion of the principal results.

621.396.5 : 621.396.11 **1750**

Transoceanic Radiotelephony.—A. Guldimann. (*Tech. Mitt. schweiz. Telegr.-Teleph Verw.*, 1st Dec. 1947, Vol. 25, No. 6, pp. 239–245. In French and German.) A general discussion of terminal equipment and of the conditions affecting the reception of long-distance signals, including fading, noise and magnetic storms.

621.396.619 : 621.397.5 **1751**

An Important Advance in Television Modulation.—(*See* 1788.)

621.396.619.11/.13 **1752**

Comparison of A.M.-F.M.—D. R. Parsons. (*Wireless Engr*, Jan. 1948, Vol. 25, No. 292, p. 33.) Comment on 1160 of April (Scroggie : Macdiarmid).

621.396.65 : 621.397.6 **1753**

2 000-Mc/s Television Program Chain.—Deerhake. (*See* 1792.)

621.396.65.029.64 **1754**

A Preview of Radio Relaying.—G. N. Thayer. (*Bell Lab. Rec.*, Nov. 1947, Vol. 25, No. 11, pp. 397–401.) Discussion of a wide-band f.m. microwave system using directive aerials for a 21-mile optical path. A similar system now operates between New York and Boston (1755 and 1756 below). Loss varies between 55 and 80 db according to weather; it is normally about 60 db. Television signals have been sent round the system twice without suffering appreciable degradation. Tests have also been made using pulse code modulation.

621.396.65.029.64 **1755**

A Microwave Relay System between New York and Boston.—A. L. Durkee. (*Bell Lab. Rec.*, Dec. 1947, Vol. 25, No. 12, pp. 437–441.) The system operates at frequencies near 4 000 Mc/s and uses eight repeater stations with an average spacing of 27.5 miles. Two 2-way communication channels are provided, each covering a signal band extending from 30 c/s to 4.5 Mc/s, and with noise and distortion characteristics satisfactory either for television signals or for a considerable number of telephone channels. Time-division or frequency-division multiplex methods are used.

621.396.65.029.64 : 621.397.743 **1756**

NY [New York] **-Boston Microwave Television Relay.**—J. M. (*Electronics*, Jan. 1948, Vol. 21, No. 1, pp. 114–116.) Seven repeater stations are used to provide line-of-sight transmission in each direction over a total effective range of 220 miles, at four frequencies in the 3 700–4 200-Mc/s band. Each repeater station uses broad-band horn aerials with beam-width 2°; metal focusing lenses give a gain of 40 db. Operation is reliable in all weathers with a transmitter power less than 1 W. Two channels are available in each direction. Each frequency is separated at the repeater by filter sections in the waveguides from the receiver horns. Provision is made for frequency control and for the elimination of picture distortion due to time delay differences for the different transmitted frequencies.

621.396.73 **1757**

WOR's Field Pick-Up Studio for Spot Broadcasts.—(*Tele-Tech*, Nov. 1947, Vol. 6, No. 11, pp. 32–33.) Four transmitters, supplied with power from a bank of storage batteries, are used for a completely self-contained mobile service on frequencies ranging from 150 Mc/s to 1.5 Mc/s.

621.396.931.029.62 + 621.396.65.029.62 **1758**

Limited Common Carrier Radio Service.—A. A. McK. (*Electronics*, Jan. 1948, Vol. 21, No. 1, pp. 97–99.) A conventional 160-Mc/s system enabling business men to maintain two-way communication, from a car or a fixed position, with a telephone operator who receives messages on behalf of the clients of the telephone answering service when their offices are closed.

621.396.97(45) : 621.396.619.13 **1759**

F.M. and Broadcasting Problems in Italy.—P. L. Bargellini. (*Tecn. elettronica*, July 1947, Vol. 2, No. 1, pp. 37–48. In Italian.) A concise account of f.m., its advantages and requirements in bandwidth and frequency, with a plea for its development on a large scale in Italy.

621.396.97(94) **1760**

Engineering Aspects of the National Broadcasting Service.—R. J. Boyle. (*Proc. Instn Radio Engrs, Aust.*, Nov. 1947, Vol. 8, No. 11, pp. 5–19. Discussion, pp. 19–22.) Australian broadcasting facilities are discussed with particular reference to New South Wales. Broadcast coverage for the m.f. and h.f. bands is considered, and details are given of the technique used for determining locations for new transmitters. The aerial systems and transmitting equipment are described and the studio switching arrangements, recording and broadcast relaying facilities are outlined.

621.398 + 621.317.083.7] : 627.8 **1761**

Radio Control for Water Works.—(*Electronics*, Jan. 1948, Vol. 21, No. 1, pp. 152..158.) A radio system of telephony, telemetry and telecontrol providing intercommunication between the pump station, the reservoir, and the water company's office.

SUBSIDIARY APPARATUS

621.526 **1762**

The Inverse Nyquist Plane in Servomechanism Theory.—G. B. Criss. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1947, Vol. 35, No. 12, pp. 1503–1504.)

621.316.57 **1763**

A Sensitive Circuit Breaker for Instrument Protection.—A. Borup. (*Electronic Engng*, Jan. 1948, Vol. 20, No. 239, pp. 26–27.)

621.316.722.1 **1764**

Electronic Voltage Regulator.—(*Bell Lab. Rec.*, Dec. 1947, Vol. 25, No. 12, pp. 452–453.) Needing only a small valve and a few resistors, this regulator made practicable the use of wind-driven generators as power supplies for early airborne radio apparatus. The relationship between anode and heater currents in the diode was used to give continuous control of the generator voltage. This method replaced the intermittent control effected by the relay type of regulator, which gave a sawtooth voltage output having harmonic frequencies which interfered with reception.

621.316.722.1 **1765**

Voltage Stabilization.—L. Liot. (*Télévis. franç.*, Nov. 1947, No. 31, pp. 25–28, 44.) Describes and compares methods using (*a*) Fe resistors in H, (*b*) carbon disks, (*c*) Ne tubes, and (*d*) triodes.

621.316.722.1 : 621.397.6 **1766**

Electron Stabilizers for Television Apparatus.—S. P. Pivovarov. (*Zh. tekh. Fiz.*, 1947, Vol. 17, No. 6, pp. 737–742. In Russian.) The anode voltage of wide-band amplifiers and scanning devices in modern television apparatus is kept constant by means of special rectifying circuits (electron stabilizers). The theory of two such circuits is discussed.

621.316.726 : 534.321.71 **1767**

Use of Rectifier with Tuning-Fork Control as Frequency-Constant A.C. Source.—H. Hertwig. (*Funk u. Ton*, 1947, No. 2, pp. 93–99.) A 100-c/s tuning fork is used for accurate frequency control of a power amplifier with neon-tube stabilization of the anode supply. Various applications are suggested.

621.318.572 **1768**

Transmitter-Blocker Cells.—R. H. Kay & M. Surdin. (*Wireless Engr*, Feb. & March 1948, Vol. 25, Nos. 293 & 294, pp. 55–61 & 75–87.) This type of cell has also been termed the a.t.r. (anti-transmitter-reception) switch and the transmitter disconnect switch. In cm-wave technique it consists of a resonant-waveguide device, between the receiver branch and the magnetron, which on reception presents a high impedance in series with the magnetron branch of the main guide and so prevents undue reception loss. Theory of the design of fixed-tuned transmitter-blocker cells is given, with an outline of experimental methods for investigating these cells. Methods are also discussed for assessing quantitatively the reception loss in a system using a cell of given edge-band impedance when operating with magnetrons of given ' cold-impedance ' characteristics.

621.352 **1769**

Recent Progress in the Study and the Manufacture of Dry Batteries.—G. Génin. (*Rev. gén. Élect.*, Jan. 1948, Vol. 57, No. 1, pp. 27–33.) Description of elements using (*a*) $HClO_4$, (*b*) AgCl and Mg, (*c*) Hg, and an account of the special features of each type. See also 3295 of 1947 (Mullen & Howard) and 1171 of April.

621.396.622.63 **1770**

An Investigation into the Use of Crystal Rectifiers for Measuring and Monitoring Purposes.—R. C. Robbins & F. W. Black. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 8, pp. 1343–1346.) Measurements of the rectification law and sensitivity of silicon-tungsten crystals of the type used for cm λ are described. The effects of the r.f. circuit impedance, of the d.c. meter resistance and of temperature changes were investigated at 50 c/s and 200 Mc/s. Temperature changes were found to have a very marked effect. High-resistance meters are preferable.

TELEVISION AND PHOTOTELEGRAPHY

621.396/.397].62 **1771**

A Complete Television Receiver.—(*Télévis. franç.*, Jan. 1948, No. 33, pp. 20–23.) Full circuit and coil winding details of a receiver with provision for radio reception on long and medium waves and on 6 short-wave bands.

621.397(083.74) **1772**

Radiophoto Standards.—S. H. Simpson, Jr, & R. E. Hammond. (*RCA Rev.*, Dec. 1947, Vol. 8, No. 4, pp. 682–697.) A short review of the development of the art and discussion of proposed standards for cylinder dimensions and speed, transmission frequency, etc.

621.397.3 **1773**

Interlocked Scanning for Network Television.—J. R. De Baun. (*RCA Rev.*, Dec. 1947, Vol. 8, No. 4, pp. 651–659.) The advantages of interlocking the scanning systems of several cameras to permit instantaneous switching-over or mixing are discussed. Possible methods are outlined.

621.397.3 **1774**

Horizontal Scanning Generator and H.V. Supply.—J. F. Bigelow. (*Tele-Tech*, Dec. 1947, Vol. 6, No. 12, pp. 56–57.) Oscillator and h.v. generator are combined in one valve. Operation is described.

621.397.331.2 **1775**

The New Television Camera — The C.P.S. Emitron.—(*Electronic Engng*, Feb. 1948, Vol. 20, No. 240, p. 59.) A photoelectric mosaic of greatly increased sensitivity is used and a method known as cathode potential stabilization is applied to eliminate undesirable shading effects and spurious signals. Advantages claimed include the possibility of a considerable reduction of studio lighting intensities, improved fidelity of colour reproduction and great depth of focus with quite moderate lighting. See also *Wireless World*, Feb. 1948, Vol. 54, No. 2, pp. 60-61.

621.397.331.2 **1776**

The Eriscope.—(*Radio franç.*, Dec. 1947, p. 24.) A French pickup tube similar in some respects to the iconoscope, but in which the photosensitive mosaic is replaced by a surface giving rise to secondary emission. The image on this surface is produced by a system of e.m. or e.s. lenses and is analysed by a cathode beam. The surface is continuous, but its electrical resistivity is great enough for the charges accumulated at each point by the secondary emission to remain localized, so that subdivision is unnecessary. The optical image on the photosensitive surface is very small, about 9 mm × 12 mm. This is enlarged 6 to 8 times by the electron-optical system. The short-focus, wide-aperture lenses used give a considerable depth of focus. This new tube gives very high definition; scanning with 800 lines or more is practicable.

621.397.331.2 **1777**

Study of Thin Slightly-Conducting Targets.—R. Barthélemy. (*C. R. Acad. Sci., Paris*, 26th Jan. 1948, Vol. 226, No. 4, pp. 292–294.) A theoretical discussion of the properties of thin targets similar to those used in the image-orthicon. See also 1778 below.

621.397.331.2 **1778**

Impact of a Scanning Beam on a Thin Target with Two Faces.—R. Barthélemy. (*C. R. Acad. Sci., Paris*, 16th Feb. 1948, Vol. 226, No. 7, pp. 532–533.) Further theoretical discussion, continuing 1777 above.

621.397.331.2 : 551.462 **1779**

Underwater Television.—C. L. Engleman. (*Electronics*, Feb. 1948, Vol. 21, No. 2, pp. 78–80.) A multiplier-orthicon camera, enclosed in a watertight cylinder, with remote focusing and target control. It has been used in Bikini lagoon down to a depth of 180 ft.

621.397.331.2 : 621.396.933 **1780**

The Storage Orthicon and Its Application to Teleran.—S. V. Forgue. (*RCA Rev.*, Dec. 1947, Vol. 8, No. 4, pp. 633–650.) The storage orthicon pickup tube has a very high capacity mosaic target and operates with a very low scanning-beam current. Charges induced on the mosaic by successive instantaneous pictures, such as would be produced by a p.p.i. for teleran, are stored and may be retransmitted as a composite television picture corresponding to the normal p.p.i. display obtained on a long-delay c.r. tube. Theory and construction details are given.

621.397.335 **1781**

Design of Simple Sync Generator.—E. M. Noll. (*Tele-Tech*, Nov. 1947, Vol. 6, No. 11, pp. 34–37.) Details of a 60-frame 260-line system without interlacing, intended for use as a basic pulse timing and shaping unit and for checking both standard and non-standard television receivers. See also 3489 of 1947 (Schoenfeld, Brown & Milwitt).

621.397.5 **1782**

Television and Colour.—J. L. Salpeter. (*Philips tech. Commun., Aust.*, Sept. 1946, No. 4, pp. 3–16.) Discussion of the Leverenz theory of the optimum screen efficiency in kinescopes and of the relation between colour television and colorimetry.

621.397.5 **1783**

Technical Aspects of Television Studio Operation.—R. W. Clark & H. C. Gronberg. (*RCA Rev.*, Dec. 1947, Vol. 8, No. 4, pp. 719–736.)

621.397.5 **1784**

TV Pick-Up from Moving Location.—(*Tele-Tech*, Dec. 1947, Vol. 6, No. 12, pp. 48, 91.) Short account of methods used for television transmission from a ship approaching New York and for retransmission from New York and Washington.

621.397.5 : 535.317.25 **1785**

The Resolving Power of a Television System.—Ya. A. Ryftin. (*Zh. tekh. Fiz.*, 1947, Vol. 17, No. 4, pp. 401–424. In Russian.) Discussion of an equivalent overall schematic for a television system, from the objective of the transmitter to the screen of the receiver. Various generalized parameters are introduced. Quantitative relationships between these parameters are established. By a suitable choice of these parameters any given conditions can be satisfied and the optimum quality for a given frequency band ensured. A number of practical conclusions are enumerated. See also 1179 of April.

621.397.5 : 535.88 **1786**

Television Projection.—M. Chauvierre. (*Radio franç.*, Dec. 1947, pp. 17–20.) A short account of the basic principles and of the use of (*a*) plastic lenses for correction of spherical aberration, and (*b*) magnets for correction of trapezoidal distortion.

621.397.5 : 535.88 **1787**

The Projection of Images on a Screen : Parts 5 & 6.—R. Aschen. (*Télévis. franç.*, Oct. & Nov. 1947, Nos. 30 & 31, pp. 12–14 & 10–11.) Continuation of 4053 of 1947. Discusses supply circuits for projection c.r. tubes and direct vision tubes.

621.397.5 : 621.396.619 **1788**

An Important Advance in Television Modulation.—(*Télévis. franç.*, Jan. 1948, No. 33, p. 24.) A short account of a method due to Gutton & Ortusi. The modulation is effected in a section of waveguide coupled to a resonant circuit. The variable capacitance of this circuit is that between the anode of a magnetron and the outer layer of the ring of electrons forming the space charge surrounding the cathode. This capacitance is small, but its variation is a maximum when the wave frequency coincides with that of the space charge. 100% modulation of several hundred watts requires no more than 1 W. The bandwidth can reach a value of 22 Mc/s on a wavelength of 23 cm. The method appears to be applicable to both a.m. and f.m., though tests for f.m. are still in progress. Other possible applications of the method are mentioned.

621.397.5 : 621.396.97 **1789**

The R.C.A. Type TJ-50A Television Mobile Unit.—W. J. Poch & H. C. Shepard. (*Broadcast News*, Sept. 1947, No. 46, pp. 44–48.) Description of a van which can be a mobile control room as well as a means of transport. Power supplies and transmission of picture and sound signals to the headquarters studio are discussed. See also 3685 of 1947 and 841 of March (Bridgewater).

621.397.6 : 621.316.722.1 **1790**

Electron Stabilizers for Television Apparatus.—Pivovarov. (*See* 1766.)

621.397.6 : 621.396.615.17 : 621.317.755 **1791**

Television Timebase.—M. Chauvierre. (*Radio franç.*, Feb. 1948, pp. 44–47.) Circuit details of a system in which the flyback is used to obtain the high voltage required for the c.r. tube.

621.397.6 : 621.396.65 **1792**

2 000-Mc/s Television Program Chain.—F. M. Deerhake. (*Electronics*, Feb. 1948, Vol. 21, No. 2, pp. 94–97.) Circuit details of the 143-mile New York/Schenectady relay using three unattended intermediate repeater stations. Two staggered r.f. channels, each 25 Mc/s wide, at present provide one-way transmission. Klystrons are used in transmitters and receivers, and a f.m. signal with 14-Mc/s swing is obtained. During the first two months of operation it was found that the frequency control of transmitter and receiver klystron obtained by temperature controlled cabinets was quite satisfactory. The frequency drift, from the instant of switching on up to normal operating temperatures, was of the order of 0.1% ; about four-fifths of this occurred in the first five minutes.

621.397.61 **1793**

Design Trends in Television Transmitters.—D.G.F. (*Electronics*, Jan. 1948, Vol. 21, No. 1, pp. 76–82.) Description, and discussion of the relative merits, of three commercial video transmitters with basically different methods of modulation, sideband suppression and output valve cooling.

621.397.61 : 621.396.619.13 : 621.396.65 **1794**

F.M. in Television.—J. S. Cordovés. (*Rev. Telecomunicación, Madrid*, Sept. 1947, Vol. 3, No. 9, pp. 43–47.) Description of a 20-W transmitter, using a carrier frequency of 1 350 Mc/s, and the associated receiver, designed as a link between a studio or outside broadcast vehicle and the main transmitter. Maximum range is about 40 km, with 72.5 db signal/noise ratio.

621.397.62 **1795**

Study and Construction of a Television Receiver.—R. Gosmand. (*Télévis. franç.*, Nov. 1947, No. 31, pp. 12–17.) A discussion of the various stages, with circuit and construction details of a receiver using a Philips MW 31-6 c.r. tube ; direct amplification and high-impedance deflection coils reduce the number of valves and result in an economical design.

621.397.62 **1796**

The Televisor.—(*Electronic Engng*, Jan. 1948, Vol. 20, No. 239, p. 25.) Discussion on the booklet mentioned in 577 of February. See also *ibid.*, Nov. 1947, Vol. 19, No. 237, p. 352.

621.397.62 : 535.88 **1797**

Large-Screen Projection Television Receiver of the Compagnie des Compteurs.—(*Radio franç.*, Jan. 1948, pp. 23–25.) The general arrangement of the receiver follows normal practice, with h.f. amplification, detection and a stage of video-frequency amplification. The amplifier chain is corrected to be perfectly linear up to 4 Mc/s. The control desk includes a direct-vision tube. The projector comprises the optical system, timebase and h.v. supply. The screen used is a multicellular structure 3 m × 2½ m. A special h.f. transformer, designed for voltages up to 90 kV between primary and secondary, is used to feed the final h.f. stage. The cathode of the projection tube, with its Wehnelt cylinder, is maintained at about −80 kV. The current in the projection tube is of the order of 500 μA. The screen is formed of a very large number of small ribbon reflectors whose dimensions are of the same order as the image elements. These reflectors give a beam concentrated in an angle of about 20° in the vertical and 45° in the horizontal plane. The image obtained using a wide-angle projection lens is of the same order of brightness as that of the normal cinema projection. See also 838 of March (Hémardinquer).

621.397.62 (443) : 621.396.82 **1798**

Television Reception Problems.—Giloteau & Raymond. (*Télévis. franç.*, Jan. 1948, No. 33, pp. 15–19.) Tests with a Pathé Marconi 47 receiver were carried out at 15 points each within 12 km of the transmitter and at one point about 30 km distant. In the latter case the receiver sensitivity was increased by decreasing the bandwidth, and with a dipole aerial and λ/4 reflector at a height of 12 m reception was satisfactory, but there was little reserve of sensitivity. At the shorter distances some trouble was experienced with ghost images, but this could usually be overcome by using a good aerial system with correct feeder matching.

621.397.645 **1799**

Correction of Video Amplifiers towards the High Frequencies.—R. Charbonnier & J. Royer. (*Télévis. franç.*, Jan. 1948, No. 33, pp. 10–14.) With the present 455-line standard, the video frequency to be transmitted is only slightly above 3 Mc/s, but for a 1 000-line standard a much wider pass-band will be required. Various circuits are discussed, and curves are given showing the improvement in h.f. response resulting from the use of each. Correction by means of two inductances is much better than that using a single inductance.

621.397.743 : 621.396.65.029.64 **1800**

NY [New York]**-Boston Microwave Television Relay.**—(*See* 1755 and 1756.)

TRANSMISSION

621.396.61 **1801**

A Chicago Kilowatt.—R. J. Higgins. (*CQ*, Dec. 1947, Vol. 3, No. 12, pp. 36–39..62.) A general description with circuit diagram and photographs of a home-made 1-kW transmitter using four 4-250A power tetrodes and fitted with safety switches.

621.396.61 **1802**

Medium-Power Table-Top Transmitter.—T. Smith. (*CQ*, Nov. 1947, Vol. 3, No. 11, pp. 41–43, 86.) 75-W R/T and c.w. complete in one compact cabinet. Full circuit and component details.

621.396.61 **1803**

Transmitter for All [amateur] **Bands, with 40-W Input.**—R. Pera. (*Tecn. elettronica*, July 1947, Vol. 2, No. 1, pp. 71–76. In Italian.) Construction and circuit details for crystal-controlled equipment.

621.396.61 : 621.396.3 **1804**

Recent Developments in Radiotelegraph Transmitters for Shore Stations.—J. F. McDonald. (*RCA Rev.*, Dec. 1947, Vol. 8, No. 4, pp. 751–764.) A description of three new keyed telegraph transmitters (15, 20 and 50 kW), for shore-to-ship communication, incorporating push-button frequency changing. Frequency ranges are 2–18 Mc/s and 350–500 kc/s.

621.396.61.029.58 **1805**

A Single-Sideband Transmitter for Amateur Operation.—A. H. Nichols. (*QST*, Jan. 1948, Vol. 32, No. 1, pp. 19–24, 128, 130.) The design, construction and operation of a single-sideband suppressed-carrier transmitter are described. Intermediate frequencies of 9 kc/s and 550 kc/s are used and the transmitted frequency is 14.2 Mc/s. The two higher oscillator frequencies are crystal-controlled and each frequency stage has a balanced modulator and filter.

621.396.615 : 621.396.712 **1806**

B.B.C. Variable-Frequency Drive Equipment for Transmitters.—W. E. C. Varley. (*B.B.C. Quart.*, Jan. 1948, Vol. 2, No. 4, pp. 244–256.) Details of design and construction of the latest equipment which uses a single, continuously variable oscillator covering the frequency range 700–1 400 kc/s. All the frequencies required for long-, medium- and short-wave bands are obtained from this by frequency multipliers, dividers and harmonic generator multipliers. The frequency can be set to the prescribed tolerance by direct dial observation, although a frequency monitor is included in the equipment to give even higher accuracy. Long-term frequency stability is obtained by proper choice of components in the frequency-determining network and their maintenance at a constant temperature. The specified r.f. output power is achieved by a wide-band amplifier in the long- and medium-wave bands and by the final stage of the harmonic generator multiplier in the short-wave band.

621.396.619 **1807**

Signal-to-Noise Ratio in Different Methods of Radio Transmission. Spectrum of Pulse Modulation.—L. J. Libois. (*Onde élect.*, Nov. 1947, Vol. 27, No. 248, pp. 411–425.) Known results for a.m. and for f.m. are briefly reviewed. The various forms of pulse modulation are then considered in detail, including pulse amplitude modulation, pulse width modulation, pulse position modulation and frequency modulation by pulses. Formulae are derived for the signal/noise ratio appropriate to each case. In order to determine correctly the spectrum of a pulse-modulated wave, precise assumptions must be made concerning the modulation process. Calculations for certain particular cases are discussed.

621.396.619 **1808**

Some Design Problems of a Modern High-Level Modulation System.—A. I. Lebedev-Karmanov & A. M. Pisarevski. (*Radiotekhnika, Moscow*, March 1947, Vol. 2, No. 3, pp. 3–17. In Russian, with English summary.) Discussion of methods for: (*a*) the suppression of dynatron oscillations, (*b*) the reduction of the input power for the submodulator, and (*c*) the application of phase compensation in the submodulator transformer circuit, with practical design details.

621.396.619.23 **1809**

Wide-Band Correction of Distortion by Reaction in High-Level Class-B Modulators.—S. V. Person. (*Radiotekhnika, Moscow*, March 1947, Vol. 2, No. 3, pp. 18–31. In Russian, with English summary.) Methods of providing for a wide frequency coverage and for the effective correction of distortion are surveyed and instructions are given for selecting the parameters of phase compensators. A method is proposed for widening the compensated frequency band by use of a modulation transformer in the circuit of the l.f. Π-network filter. Means are suggested for increasing the transformer leakage inductance.

621.397.61 **1810**

Design of Television Transmitters for Low Level Modulation.—J. W. Downie, L. M. Ewing, H. B. Fancher & J. E. Keister. (*Tele-Tech*, Dec. 1947, Vol. 6, No. 12, pp. 44–47 . . 89.) Study of available methods led to the adoption of low-level modulation; the required power was obtained by linear amplifiers. Grounded-grid triodes operating in push-pull are used in the four power-amplifier stages. A sweep generator is incorporated for alignment of the different stages. Details are given of the method of tuning.

VALVES AND THERMIONICS

537.291 : 621.385 : 621.317.329 **1811**

Electrolyte-Tank Study of Electron Beams, taking account of Space Charge.—G. Goudet & R. Musson-Genon. (*J. Phys. Radium*, July 1945, Vol. 6, No. 7, pp. 185–195. In French.) A method of successive approximations enables the electrolyte tank to be used to obtain the potential distribution in a valve. The method is also applicable to other problems involving an equation of the Poisson type. A generalization of Langmuir's law is given in an appendix.

537.291 : 621.385.1 **1812**

Space-Charge Spreading of a Cylindrical Electron Beam near a Cathode.—G. Goudet & A. M. Gratzmuller. (*J. Phys. Radium*, June 1945, Vol. 6, No. 6, pp. 153–162. In French.) Discussion of the electron beam emitted by a plane circular cathode surrounded by a guard ring and accelerated by an infinite plane anode parallel to the cathode. The trajectory of a peripheral electron is calculated, with certain simplifying assumptions, by applying the theorem of electrical images and representing all unknown quantities by Fourier series. The beam divergence depends only on the ratio α of the distance between anode and cathode to the radius of the beam. A curve is given showing the relative increase of the radius of the beam, at the level of the anode, as a function of α.

621.383 **1813**

The Preparation of Thallium Sulphide Photocells.—B. T. Kolomiets. (*Zh. tekh. Fiz.*, 1947, Vol. 17, No. 2, pp. 195–202. In Russian.) Detailed description of the manufacturing process as developed at the Leningrad Technical Physics Institute. The main difference between this method and those of other authors is that the photosensitive semiconducting layer is obtained by evaporating previously prepared thallium sulphide.

621.383 **1814**
Local Variations of the Sensitivity of Photocells.—J. Terrien, C. Anglade & G. Touvay. (*C. R. Acad. Sci., Paris*, 10th Dec. 1947, Vol. 225, No. 23, pp. 1142–1144.) The sensitivity distribution was studied for two types of cell; (*a*) Cs cells with cylindrical anode and plane cathode (C.S.F., Paris); (*b*) KMV6 and RMV6 cells with grid anode and rectangular plate cathode (Osram, London). Wide variations, of the order of 2 : 1, were found for both types, and the equisensitive contours were very irregular.

621.383 **1815**
Lead Selenide Cells for Infra-Red Spectroscopy.—D. E. Blackwell, O. Simpson & G. B. B. M. Sutherland. (*Nature, Lond.*, 6th Dec. 1947, Vol. 160, No. 4075, p. 793.) Photocells made by Simpson's method (1376 of May) have two maxima, near 1.6μ and near 3.3μ. With a quartz envelope instead of pyrex the effective range is extended beyond 3.4μ and with a suitable window it may be possible to extend the useful range to 4μ and beyond.

621.383 : 621.316.722.1 **1816**
Improvement of the Characteristics of Photo-Voltaic and Photo-Conductive Cells by Feedback Circuits.—E. S. Rittner. (*Rev. sci. Instrum.*, Jan. 1947, Vol. 18, No. 1, pp. 36–38.) The decrease of current sensitivity of these cells with increasing load resistance can be avoided by maintaining constant voltage across the cell. Two stable electronic circuits for this purpose are described.

621.383.032.216 **1817**
Hot-Cathode Photocell.—J. Debiesse & R. Champeix. (*C. R. Acad. Sci., Paris*, 19th Jan. 1948, Vol. 226, No. 3, pp. 234–236.) The cell has a cathode coated with a mixture of the oxides of Ba and Sr. Results of tests are given with either a resistance of several megohms or a microammeter in the anode circuit. The sensitivity depends on the state of activation of the cathode.

621.385.1 **1818**
Two New V-Valves.—O. P. Herrnkind. (*Funk u. Ton*, Jan. 1948, No. 1, pp. 26–27.) Full electrical data and characteristics of triode-hexode VCH11 and pentode VF14.

621.385.1 **1819**
Oscillation Frequency Limits for Grid-Controlled Valves.—L. Ratheiser. (*Radio Tech., Vienna*, 1947, Vol. 23, Nos. 11/12, pp. 501–505.) A general discussion of the maximum frequencies obtainable with various circuits using normal valves, with a short reference to special valves designed for u.h.f. operation.

621.385.1 : 621.395.61 : 534.43 **1820**
A Vacuum-Tube-Type Transducer for Use in the Reproduction of Lateral Phonograph Recordings.—J. F. Gordon. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1947, Vol. 35, No. 12, pp. 1571–1575.) A plane-parallel triode with the grid structure pivoted at one end and connected directly to a stylus through a 0.002-inch Kovar diaphragm. The overall height of the tube is 2.3 cm and it may be mounted in a standard arm. Characteristic curves show that the harmonic distortion is very low. A conventional RC coupling in the anode circuit will give an output of 1 V from a standard shellac record.

621.385.1 : 621.396.621.53 **1821**
International Frequency Changer Equivalents.—L. Ratheiser. (*Radio Tech., Vienna*, 1947, Vol. 23, Nos. 8/9, pp. 429–434.) Tables of the principal characteristics of the international series of triode-hexodes, triode-heptodes, heptodes (pentagrid-converters) and octodes.

621.385.1(44) **1822**
Development of Valve Technique.—M. Descarsin. (*Onde élect.*, Nov. 1947, Vol. 27, No. 248, pp. 399–410.) A historical review of developments in France since August 1914, when bright-emitter valves began to be used for the French and allied armies. Particular attention is paid to construction methods adapted to mass production and which can be used with little or no variation throughout a whole series of valves with outputs ranging from a few watts to several kilowatts.

621.385.1.032.21 : 621.315.591† : 537.533.8 **1823**
On the Autoelectronic Emission from Complex Semiconducting Cathodes.—N. D. Morgulis. (*Zh. tekh. Fiz.*, 1947, Vol. 17, No. 9, pp. 983–986. In Russian.) Formulae (5) and (6) are derived determining the autoelectron current for comparatively weak external fields ($E \leqslant 5 \times 10^5$ V/cm). These formulae differ considerably from the Fowler-Nordheim formula for metals.

621.385.1.032.216 **1824**
Cathode Problems.—L. Ratheiser. (*Radio Tech., Vienna*, 1947, Vol. 23, Nos. 8/9, pp. 385–388.) Discusses briefly the theory and properties of oxide cathodes, and the development of special types for modern valves.

621.385.1.032.216 : 537.533.1 : 537.583 **1825**
Tangential Electron Emission.—(*Tele-Tech*, Jan. 1948, Vol. 7, No. 1, pp. 45..88.) Summary of 872 of March (Klemperer).

621.385.1.032.216 : 537.533.8 **1826**
Emission from an Oxide Cathode.—S. V. Ptitsyn. (*Zh. tekh. Fiz.*, 1947, Vol. 17, No. 9, pp. 965–982. In Russian.) Attempts to study the operation of oxide cathodes under pulse conditions have revealed the inadequacy of our knowledge of those physical processes in the cathodes which govern the emission of electrons.

Accordingly a detailed investigation of such cathodes was undertaken under the following headings:—(*a*) structure, (*b*) core, (*c*) semiconducting layer, (*d*) barrier layer, (*e*) emission properties, (*f*) operation under pulse conditions, (*g*) causes limiting emission under pulse conditions, and (*h*) poisoning of the cathode by current emission.

621.385.1.032.3 : [546.78 + 546.84 **1827**
Designing Thoriated Tungsten Filaments.—Dailey. (*See* 1655.)

621.385.2 : 621.317.79 : 621.396.822 **1828**
A Diode Noise Generator.—Moffatt. (*See* 1693.)

621.385.2 : 621.396.822 **1829**
The Reduction of the Shot Effect in Cylindrical Diodes.—L. A. Weinstein. (*Zh. tekh. Fiz.*, 1947, Vol. 17, No. 9, pp. 1035–1044. In Russian.) A theory is developed for the case in which the current is reduced by the space charge. The results obtained show that the shot effect in a cylindrical diode may be less than in a plane diode.

621.385.3.011.4.032.2 **1830**

Inter-Electrode Capacitances of Triode Valves at Ultra-High Frequency and Their Dependence on the Operating Conditions.—D. K. Ganguli & S. R. Khastgir. (*Indian J. Phys.*, Aug. 1947, Vol. 21, No. 4, pp. 153–167.) Six triodes were examined at 66.76 Mc/s by connecting the capacitance to be determined across a Lecher system and measuring the length of line required to produce resonance. The variations of the interelectrode capacitances with increase of anode current are described and the reasons for these variations are discussed.

621.385.4 : 621.396.645 **1831**

Operating Conditions and Circuits for Valve Type 807.—G. M. Thompson. (*Philips tech. Commun., Aust.*, Aug. 1947, No. 7, pp. 14–23.) Complete data and characteristics for the Philips 807 beam tetrode and circuit details for a 60-W power amplifier and modulator, a r.f. amplifier or doubler, a series-tuned doubler and a push-pull r.f. amplifier.

621.385.5 **1832**

A Study of the Operation of Pentodes with Variable Screen Voltage.—F. Job. (*Câbles & Transmission, Paris*, Oct. 1947, Vol. 1, No. 3, pp. 245–253. With English summary.) The gain of a pentode with variable screen voltage can be calculated from a knowledge of the internal resistance as a triode, the ratio of anode current to screen current and the corresponding parameters (slope and internal resistance as a pentode) when operating with a fixed screen voltage. Application is made to the case of a pentode with screen connected to the anode battery through an impedance. It is also shown that by suitable decoupling of cathode, anode and screen, the gain of a pentode can be made absolutely independent of frequency.

621.385.5 : 621.317.31 **1833**

Measurement of Small Currents : Characteristics of Types 38, 954, and 959 as Reduced Grid Current Tubes.—Nielsen. (*See* 1673.)

621.385.831.029.64 **1834**

Wide-Band Amplifier Valves for Centimetre Waves.—Touraton, Zwobada & Dumousseau. (*Onde élect.*, Oct. 1947, Vol. 27, No. 247, pp. 361–370.) For high-definition television and also for multiplex telephony with a large number of channels, wide frequency bands must be covered and special high-power valves are essential. Relatively simple modifications of the klystron have resulted in the production of valves operating on a mean frequency of 3 000 Mc/s, with a power gain of the order of 40 in a frequency band of 50 Mc/s and an output of about 10 W. The principles used in the construction of these valves are described fully and experimental results are given for the first sealed model produced.

621.385.832 **1835**

Cathode-Ray Tube Data.—D. W. Thomasson. (*Wireless World*, Dec. 1947, Vol. 53, No. 12, pp. 484–485.) Characteristics of some ex-Service surplus types.

621.385.832 : 535.371.07 **1836**

Performance Characteristics of Long-Persistence Cathode-Ray Tube Screens ; Their Measurement and Control.—Johnson & Hardy. (*See* 1653.)

621.385.832 : 621.396.662 **1837**

A Useful Tube.—E. Leslie. (*Radio Craft*, Oct. 1947, Vol. 19, No. 1, p. 23.) Description and applications of a new c.r. tuning indicator, 6AL7-GT.

621.385.832 : 621.396.96 **1838**

The Skiatron or Dark Trace Tube.—G. Wikkenhauser. (*Electronic Engng*, Jan. 1948, Vol. 20, No. 239, pp. 20–22.) For other accounts see 2404 of 1946 (King : Watson) and 888 of March (King & Gittins).

621.396.615.141.2 **1839**

The Mechanism for exciting Oscillations in a Multi-Segment Magnetron.—A. A. Slutskin. (*Zh. tekh. Fiz.*, 1947, Vol. 17, No. 4, pp. 425–434. In Russian.) In magnetrons with many anode segments, oscillations can occur which are practically independent of the magnetic field intensity. The period of these oscillations is smaller than the electron transit time. A theoretical analysis of these oscillations is given, based on the consideration of the energy exchange between the electrons leaving the cathode and the oscillatory circuits between the segments of the anode. For small oscillation amplitudes and small distances between the adjacent segments conditions for the occurrence of the oscillations are established and a formula (17) determining the oscillatory power is derived.

621.396.615.141.2 **1840**

The Multiple Cavity Magnetron.—P. Lombardini. (*Tecn. elettronica*, July 1947, Vol. 2, No. 1, pp. 25–36. In Italian.) Principles of operation are considered, with particular attention to oscillation modes and mode separation. Reference is made to British and American work: see 293 of 1947 (Fisk, Hagstrum & Hartman).

MISCELLANEOUS

53 Planck **1841**

Max Planck.—L. de Broglie. (*Rev. gén. Élect.*, Dec. 1947, Vol. 56, No. 12, pp. 475–477.) A short biography, with an account of some of Planck's contributions to modern theoretical physics.

621.396 Popov **1842**

Alexander S. Popov.—G.W.O.H. (*Wireless Engr*, Jan. 1948, Vol. 25, No. 292, pp. 1–5.) A review of his life and work, with special reference to the rival claims of Popov and Marconi to be the inventor of radio communication. See also 1218 and 1219 of April, and 4100 of 1947.

017.4 : 6(43) **1843**

Technical Index of Reports on German Industry : Part 4. [Book Notice]—H.M. Stationery Office, London, 43 pp., 2s. Deals with reports published between 31st Dec. 1946 and 27th March 1947.

017.4 : 621.38/.39 **1844**

RCA Technical Papers Index : Vol. I [1919–1945] **Vol. IIa** [1946]. [Book Notice]—Radio Corporation of America, Princeton, N.J., 143 + 21 pp., gratis. (*Wireless Engr*, June 1947, Vol. 24, No. 285, p. 167.) A list of papers published in English on radio, electronics and related subjects, the author or co-author of which was associated with R.C.A. Vol. IIb [1947], 24 pp., gratis, has also appeared.

ABSTRACTS and REFERENCES

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to it.

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ACOUSTICS AND AUDIO FREQUENCIES

534.132 **1845**

On the Radiation of Sound from an Unflanged Circular Pipe.—H. Levine & J. Schwinger. (*Phys. Rev.*, 15th Feb. 1948, Vol. 73, No. 4, pp. 383–406.) Full paper. Summary abstracted in 628 of March.

534.321.9 **1846**

On the Measurement of Ultrasonic Wavelengths using Two Beams of Progressive Waves.—A. Giacomini. (*Rend. Accad. naz. Lincei*, June 1947, Vol. 2, pp. 791–794. Reprint.) The method is a modification of that of Bachem, Hiedemann & Asbach (1934 Abstracts, p. 273). It is based on the fact that a system of stationary waves is equivalent to the superposition of two systems of progressive waves of equal frequency and amplitude moving in opposite directions. A parallel beam of light is passed through the cell containing the liquid under test and an image of the stationary-wave system is projected on to a screen.

534.321.9 : 621.391.63 **1847**

Ultrasonic Cell of Large Area for the Modulation of Light.—A. Giacomini. (*Alta Frequenza*, Oct./Dec. 1943, Vol. 12, Nos. 10/12, pp. 409–416. In Italian, with English, French and German summaries.) A linear mosaic of quartz down the centre of a rectangular glass cell containing xylol generates ultrasonic waves in the liquid. These waves, of frequency 5 Mc/s or more, can be used to modulate a beam of light passing through the cell. Applications to phototelephony and phototelemetry are described, with experimental results.

534.756 **1848**

The Relaxation Theory of Hearing.—Ya. I. Frenkel. (*C. R. Acad. Sci. U.R.S.S.*, 1st Feb. 1948, Vol. 59, No. 4, pp. 679–681. In Russian.)

621.395.61/.62 : 621.392.51 **1849**

Characteristic Quantities of Electromechanical Transducers.—I. Barducci. (*Atti Accad. naz. Lincei*, Feb. 1947, Vol. 2, No. 2, pp. 190–196. Reprint.) P. G. Bordoni (*ibid.*, 1946, Vol. 1, p. 1324) introduced a new type of mixed electromechanical coupling impedance, defined as the ratio between a mechanical force and an electric current. Using this quantity, the behaviour of any transducer can be expressed by a single set of equations.

Starting from the general equations thus obtained, dynamic impedance transfer, sensitivity and efficiency are calculated and a coupling factor is derived which is real, dimensionless, has values between 0 and 1, and is independent of the sense of the transformation. This coupling factor seems to be an improved means of estimating the goodness of electromechanical coupling and of comparing various types of coupling.

The characteristic quantities for electromechanical resistance and capacitance coupling are tabulated and it is shown that short-circuit dynamic impedances satisfy a reciprocity theorem that has the same form for electric circuits, mechanical systems or electromechanical transducers.

621.395.623.8 **1850**

Two-Way Speaker System: Parts 1-3.—C. G. McProud. (*Audio Engng, N.Y.*, Nov. & Dec. 1947, Vol. 31, Nos. 10 & 11, pp. 18–22 & 17–19, 35, & Feb. 1948, Vol. 32, No. 2, pp. 21–23, 38.) Details of the construction and assembly of a high-frequency unit and horn, a low-frequency speaker and a suitable enclosure for it, and a dividing network to pass the appropriate frequencies to the two sections of the system. See also 3816 of 1947.

621.395.625.3 **1851**

Review of the Present Status of Magnetic Recording Theory: Parts 1-3.—W. W. Wetzel. (*Audio Engng, N.Y.*, Nov. 1947–Jan. 1948, Vol. 31, Nos. 10 & 11, & Vol. 32, No. 1, pp. 14–17, 39, pp. 12–16, & pp. 26–30 .. 47.) Part 1 describes a hysteresis loop tester and the measurements that can be made with it. The residual induction in a recorded tape may be expected to decrease with decreasing wavelength. The residual induction is governed mainly by the coercivity of the material at short wavelengths and by the remanence at long wavelengths. Part 2 discusses current theories of erasing, recording and reproduction, particular attention being given to recording theory. Part 3 summarizes the above and gives practical illustrations. Noise and distortion phenomena are examined from the experimental point of view, since the relevant theories are far from complete.

621.395.625.3 : 534.76 **1852**

Arrangement for Note Location on Magnetophon Tape.—H. Gunka & W. Lippert. (*Funk u. Ton*, March 1948, No. 3, pp. 125–134.) A reproducing head follows a circular path formed by a section of the tape, which can be easily marked or cut when a particular note is heard. The device includes provision for periodic sampling. Possible applications are suggested.

621.395.625.6 **1853**

A Newly Developed Light Modulator for Sound Recording.—G. L. Dimmick. (*J. Soc. Mot. Pict. Engrs*, July 1947, Vol. 49, No. 1, pp. 48–57.) Very low distortion and greatly improved performance are claimed. The modulator is of the magnetic type and is mechanically and optically interchangeable with existing R.C.A. sound-recording galvanometers. The power required for 100% modulation is 1.25 W. Distortion characteristics, frequency-response curves, and impedance data are discussed, and the effect of bias upon performance is considered.

AERIALS AND TRANSMISSION LINES

621.315.212 : 621.392.43 **1854**

The Series Reactance in Coaxial Lines.—H. J. Rowland. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1948, Vol. 36, No. 1, pp. 65–69.) The effect of reactance in series with the inner conductor is investigated; such reactance can be used for direct impedance matching without the protruding stubs necessary for parallel compensation. The reactors take the form of step discontinuities in the diameter of the inner conductor. See also 736 of 1945 (Whinnery et al.).

621.392.029.64 **1855**

A New Type of Waveguide Directional Coupler.—H. J. Riblett & T. S. Saad. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1948, Vol. 36, No. 1, pp. 61–64.) The coupler has been measured for λ 3.1–3.5 cm. It has high directivity, low input s.w.r., is easy to design and has many applications. Theory, design and performance curves are given. A system of pairs of slots at right angles is cut in the wall common to two waveguides. These slots have compensating frequency characteristics so that directional couplers with very flat coupling characteristics can be produced. See also 1007 of 1947 (Early) and 2007 of 1947 (Mumford).

621.392.029.64 : 621.317.78 **1856**

The Enthrakometer, an Instrument for the Measurement of Power in Rectangular Wave Guides.—Collard. (*See* 2020.)

621.392.029.64 : 621.396.662.029.64 **1857**

Note on Wave-Guide Attenuators.—Miller, Crowley-Milling & Saxon. (*See* 1892.)

621.396.67 **1858**

Theory of the Circular Diffraction Antenna.—A. A. Pistolkors. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1948, Vol. 36, No. 1, pp. 56–60.) The e.m. field produced by an aerial in the form of a circular gap in a conducting plane is investigated. The method is based on the classical diffraction theory of Fresnel and Kirchhoff. The electric field intensity at a distance is calculated from the expressions obtained for E and H, the directional patterns are plotted and an expression for gap admittance is obtained.

621.396.67 **1859**

Wavelength Lenses [polyrod aerials].—G. Wilkes. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1948, Vol. 36, No. 2, pp. 206–212.) A mathematical analysis of a system consisting of a dielectric block in front of a horn or open-ended waveguide. The theory is approximate, but fair agreement is obtained with experimental determinations of lens patterns and gain.

621.396.67 : [538.311 + 538.32 **1860**

Currents excited on a Conducting Plane by a Parallel Dipole.—Dunn & King. (*See* 1910.)

621.396.671 **1861**

Determination of Aerial Gain from Its Polar Diagram.—J. A. Saxton. (*Wireless Engr*, April 1948, Vol. 25, No. 295, pp. 110–116.) "On the assumption that the field-strength distribution in the main forward lobe of a highly directive aerial may be represented by an ellipsoid, and that only a very small fraction of the total energy is radiated in side lobes, it is shown that the power gain of the aerial, compared with a doublet radiator, is $\frac{8\phi^2}{3}$. Here ϕ is the ratio of the major to the minor axis of the ellipsoid. The validity of this approximation in certain circumstances has been demonstrated by measurements of the polar diagrams and gains of some aerials used for centimetre wavelengths."

621.396.671 **1862**

Radiation Resistance of Ring Aerials.—H. Page. (*Wireless Engr*, April 1948, Vol. 25, No. 295, pp. 102–109.) Radiation resistance formulae are derived. Systems with anti-fading properties, consisting of vertical aerials equally spaced around a circle whose radius is comparable with λ, are considered. The currents in the aerials have the same amplitude, but the phase changes progressively round the ring, the total phase change being an integral multiple of 2π radians. A special case of in-phase ring currents with a central aerial is also discussed.

621.396.671 : 518.4 **1863**

Calculation of Small Horizontal Rhombic Aerials.—B. van Dijl. (*Tijdschr. ned. Radiogenoot.*, Jan. 1948, Vol. 13, No. 1, pp. 23–31. In Dutch, with English summary.) A family of curves is given to facilitate calculation of radiation patterns.

621.396.677 **1864**

An Automatic Contour Plotter for the Investigation of Radiation Patterns of Directive Antennae.—J. Dyson & B. A. C. Tucker. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 9, pp. 1403–1406.) The directional characteristics of the receiver aerial system under test are presented as a family of received-signal contours. A Cartesian plot is used with azimuth and elevation angles forming the respective axes. For lecture summary see *ibid.*, Part IIIA, 1946, Vol. 93, No. 9, pp. 214–215.

CIRCUITS AND CIRCUIT ELEMENTS

531 : 621.392 **1865**

Contribution to the Study of Electromechanical Analogies.—M. Nuovo. (*Mem. Accad. naz. Lincei*, 1946, Vol. 1, pp. 26–50. Reprint.) A general discussion of the correct application of both the 'classical' analogy, due originally to Maxwell, and the 'modern' one, due to Firestone and Hecht, starting in both cases either from a given circuit or a given set of differential equations. Matrix algebra is used, and some illustrative examples are appended.

621.3.018.4 **1866**

On the Concept of Negative Frequency.—G. B. Madella. (*Alta Frequenza*, March 1944, Vol. 13, No. 1, pp. 31–38. In Italian, with English, French and German summaries.) The concept has a definite application to polyphase systems but not to monophase systems. The phenomena of frequency conversion are examined and it is shown that this idea permits a very simple representation of the results by means of expressions in which both the magnitudes and the signs of the frequencies in question are taken into account. See also 1867 and 2013 below.

621.3.018.4 **1867**

Positive and Negative Frequencies.—N. F. Barber. (*Wireless Engr*, March 1948, Vol. 25, No. 294, p. 98.) Comment on 669 of March (Madella). The new points of view regarding negative frequencies have been more fully discussed by Madella (1866 above and 2013 below).

621.314.2 + 621.396.619.23 **1868**

Rectifier Resistance Laws.—D. G. Tucker. (*Wireless Engr*, April 1948, Vol. 25, No. 295, pp. 117–128.) Discussion of an exponential relationship

$$R = R_0 + \kappa\epsilon^{-qV}$$

between the resistance R of a rectifier and the voltage V across it, where R_0, κ and q are constants for any particular rectifier. For forward and small backward voltages the relationship agrees well with experimental results; for large backward voltages the agreement is less good, but R is so large compared with R_0 that the usefulness of the relationship is little affected, at any rate for the ring, Cowan, and constant-impedance modulator circuits to which it is here applied. The agreement is best for diodes and least good for crystal valves; its adaptation to measured rectifier characteristics is discussed fully. The relationship applies to d.c. or a.c. resistance. It is assumed throughout that rectifier capacitance is small, and that the amplitude of the a.c. signal is sufficiently small for dV/dI to be taken as the a.c. resistance, I being the rectifier current.

621.314.3† **1869**

The Transductor [or magnetic amplifier].—H. B. Rex. (*Instruments*, Dec. 1947, Vol. 20, No. 12, pp. 1102–1109.) Based on a series of articles in *Arch. Elektrotech.*, 1942–44. A complete theoretical analysis of the transductor: (*a*) with natural magnetization, i.e., with sinusoidal voltages in the control windings, (i) without self-excitation, (ii) with self-excitation under various feedback conditions, which are analysed and their effect upon the performance discussed; (*b*) with constrained magnetization, where only d.c. flows in the control windings.

621.316.82 **1870**

Rheostat Trigger Circuits.—S. A. Drobov. (*Radiotekhnika, Moscow*, Jan./Feb. 1948, Vol. 3, No. 1, pp. 40–50. In Russian.)

621.392 **1871**

Resistor-Transmission-Line Circuits.—P. I. Richards. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1948, Vol. 36, No. 2, pp. 217–220.) "Necessary and sufficient conditions are derived for a function to be the driving-point impedance of a physically realizable network consisting (essentially) of lumped resistors and lossless transmission lines. The circuits so developed are thoroughly practical for pure reactances and in many other special cases, but, in general, ideal transformers are sometimes required. A rigorous correspondence between lumped-constant circuits and line-resistor circuits is established."

621.392 **1872**

Response of a Circuit to an E.M.F. of Sawtooth Waveform.—F. Bedeau. (*Rev. tech. Comp. franç. Thomson-Houston*, May 1947, No. 7, pp. 39–45. In French with English summary.) Carson's formulae for the response of a circuit to an e.m.f. of any waveform are often difficult to apply. Graphical methods permit considerable simplifications and Nerken's method (3190 of 1937) can be further simplified for sawtooth waveforms, so that the response can be obtained by simple planimetry. A similar method is applicable to rectangular signals.

621.392 : 621.314.25 **1873**

The Conversion of Two Potentials (or Currents) of Different Phases to Two Potentials (or Currents) of the Same Phase with an Amplitude Ratio determined by the Phase Difference.—H. Thiede. (*Funk u. Ton*, March 1948, No. 3, pp. 111–118.) Suitable circuits for this transformation are described. Applications discussed include the display of phase difference on a c.r.o.

621.392 : 621.396.96 **1874**

Introduction to Circuit Techniques for Radiolocation.—F. C. Williams. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, pp. 289–308.) "The words 'circuit technique' have come to have a special meaning in radar. Roughly this field may be said to include the generation of waveforms, both sinusoidal and otherwise, and their manipulation to meet specific needs. It includes also servomechanisms of the instrument type and their associated special amplifiers. The particular aspects of these processes which radar has mainly affected have been precision, reliability and producibility, since vast numbers of similar equipments have been called upon to operate under singularly adverse conditions, and have been required to give visual or other indications to a high degree of precision."

The paper deals mainly with the question of waveform generation and manipulation, and "the aim has therefore been to explain the basic circuit elements, and their use, and to show by example how the necessary design calculations are undertaken."

621.396.611 **1875**

Trigonometric Components of a Frequency-Modulated Wave.—E. Cambi. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1948, Vol. 36, No. 1, pp. 42–49.) The exact solution of the differential equation of a resonant circuit having either variable capacitance or inductance is given in a form having a clear physical meaning and allowing accurate numerical computation. Results are compared with those of approximate formulae. Approximate expressions, valid for small percentage changes of L or C, are deduced from the rigorous solution.

621.396.611.1 **1876**

Universal Impedance Diagrams for Parallel Resonant Circuits.—A. Madella-Lucarelli. (*Alta Frequenza*, July/Sept. 1943, Vol. 12, Nos. 7/9, pp. 366–370. In Italian, with English, French and German summaries.) Diagrams with non-dimensional coordinates applicable to circuits comprising a capacitor shunted by an inductor and resistor in series. Diagrams are given for various values of Q for the inductor at the ideal resonance frequency and also for constant ratio between the actual frequency and the ideal resonance frequency.

621.396.611.21 : 549.514.51 **1877**

High-Frequency Plated Quartz Crystal Units.—R. A. Sykes. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1948, Vol. 36, No. 1, pp. 4–7.) Discussion of development problems, mounting methods, and frequency adjustment by means of evaporated gold. See also 3222 and 3224 of 1944.

621.396.615 **1878**

A Tunable Vacuum-Contained Triode Oscillator for Pulse Service.—C. E. Fay & J. E. Wolfe. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1948, Vol. 36, No. 2, pp. 234–239.) A tunable push-pull triode oscillator is described in which the oscillatory circuit is contained in an evacuated envelope with the valve components. A pulse peak power output of more than ½ MW is delivered through a 50-Ω line in the frequency range 390–435 Mc/s.

621.396.615 **1879**

Theory and Practice of the Transitron Oscillator.—R. Lemas. (*Télévis. franç.*, March 1948, No. 35, pp.

12–15.) Families of curves are given which show how the negative-resistance portion of the transitron characteristic depends on the various circuit parameters. Transitron circuits give a good waveform with very good frequency stability. Operation for pulse generation will be discussed later.

621.396.615 **1880**

On the Operation of a Blocking Oscillator.—D. M. Levitas & V. V. Migulin. (*Zh. tekh. Fiz.*, Oct. 1947, Vol. 17, No. 10, pp. 1171–1180. In Russian.)

621.396.615 **1881**

Resistance-Capacitance Oscillator.—G. Francini. (*Alta Frequenza*, March 1944, Vol. 13, No. 1, pp. 5–17. In Italian, with English, French and German summaries.) The use of a negative-transconductance valve enables a simple oscillator to be constructed with a single valve instead of the usual two or three. An equation is given which takes account of the nonlinearity of valve characteristics and is analogous to that for the inductance-capacitance oscillator. Design criteria are established, frequency limits determined, and a practical circuit described.

621.396.615 : 549.514.51 **1882**

Negative-Resistance Crystal Oscillators.—A. Pinciroli. (*Alta Frequenza*, March 1944, Vol. 13, No. 1, pp. 18–30. In Italian, with English, French and German summaries.) Theoretical discussion, based on equivalent circuits, of pentode oscillators differing essentially from the normal Pierce circuits. The quartz crystal is connected between the suppressor and screen grids and the screen voltage is much higher than the anode voltage. Curves show the relation between frequency and the variations of the various circuit parameters. With proper choice of these parameters a high degree of frequency stability is possible.

621.396.615 : 621.316.72 **1883**

Theory of Amplitude-Stabilized Oscillators.—P. R. Aigrain & E. M. Williams. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1948, Vol. 36, No. 1, pp. 16–19.) The performance of generalized amplitude-stabilized oscillators is analysed in terms of a stability factor. Theoretical calculations are made for stabilization with various types of nonlinear control elements, whose properties are tabulated. The circuit of an improved stabilized oscillator is described.

621.396.615.17 **1884**

The Degenerative Positive-Bias Multivibrator.—S. Bertram. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1948, Vol. 36, No. 2, pp. 277–280.) "The operation of a multivibrator with positive grid supply and cathode degeneration is described. It is shown that, for suitable circuit parameters, the frequency of the multivibrator is very nearly a linear function of the applied grid voltage. Since the grid voltage can be controlled with relatively simple auxiliary circuits, the positive-bias multivibrator becomes a useful variable-frequency source."

621.396.615.18 **1885**

Negative-Transconductance Frequency Divider.—A. Bressi. (*Alta Frequenza*, Oct./Dec. 1943, Vol. 12, Nos. 10/12, pp. 417–427. In Italian, with English, French and German summaries.) The behaviour as multivibrator of a sawtooth relaxation oscillator with a single negative-transconductance valve is examined. Applications to the construction of frequency dividers for a quartz clock are discussed.

621.396.619.13 **1886**

Distortion of F.M. Signals in Passage through Electrical Networks.—F. L. H. M. Stumpers. (*Tijdschr. ned. Radiogenoot.*, Jan. 1948, Vol. 13, No. 1, pp. 1–21. In Dutch, with English summary.) Full account of part of the work described in 2221 of 1947.

621.396.645 **1887**

The Cathode Amplifier.—W. Geyger. (*Funk u. Ton*, March 1948, No. 3, pp. 119–124.) General theory and a summary of the particular advantages of this type of amplifier.

621.396.645 **1888**

Harmonic-Amplifier Design.—R. H. Brown. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1948, Vol. 36, No. 1, p. 84.) Discussion on 61 of January.

621.396.645 **1889**

Design of Wide-Band Amplifiers.—J. Harmans. (*Funk u. Ton*, Feb. 1948, No. 2, pp. 72–80.) A design method is developed for amplifiers comprising a number of detuned circuits. The conditions necessary for the amplifiers to have approximately square frequency/amplification curves are also determined.

621.396.645 : 621.396.615.142 **1890**

Application of Velocity-Modulation Tubes for Reception at U.H.F. and S.H.F.—M. J. O. Strutt & A. van der Ziel. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1948, Vol. 36, No. 1, pp. 19–23.) When such valves are used as pre-amplifiers, a special arrangement of three electrode pairs spaced along the electron stream is recommended. The noise factor can thereby be reduced from several thousand to about ten, with no loss of gain. The first pair of electrodes is connected to a resonant line or cavity and constitutes a preselector circuit; the second is connected to the input and the third to the output circuit. It is suggested that experiments by E. Barlow (I.R.E. Electron-Tube Conference, New Haven, Conn., June 1946), which failed to realize such noise reduction, should be repeated under conditions conforming to this analysis.

621.396.645.36 **1891**

Class-A Push-Pull Amplifier Theory.—H. L. Krauss. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1948, Vol. 36, No. 1, pp. 50–52.) Two valves operating in push-pull, class-A_1, have more than twice the power output of a single valve operating at the same voltages; optimum load values are assumed in each case. This is demonstrated analytically, and explained in terms of the change in load impedance seen from one valve caused by coupling to the other. Experimental data confirm the theory.

621.396.662.029.64 : 621.392.029.64 **1892**

Note on Wave-Guide Attenuators.—C. W. Miller, M. C. Crowley-Milling & G. Saxon. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 9, pp. 1477–1478: summary, *ibid.*, Part IIIA, 1946, Vol. 93, No. 1, p. 227.) A practical paper describing the design of fixed and variable attenuators. For operation at low power levels a carbon-loaded absorbing material is used, and at higher levels the power is absorbed in flowing water.

621.396.662.33.029.62 **1893**

A 35 Mc/s High-Pass Filter.—P. F. Cundy. (*R.S.G.B. Bull.*, March 1948, Vol. 23, No. 9, pp. 174–175.) Details of a filter, consisting of one constant-*K* and one *m*-derived section, designed to eliminate, in television reception, second-channel interference from transmissions in the 28-Mc/s amateur band.

621.396.69 **1894**

Printed-Circuit Techniques.—C. Brunetti & R. W. Curtis. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1948, Vol. 36, No. 1, pp. 121–161.) A comprehensive discussion, with a bibliography of 60 references. See also 1913 of 1947 (Sargrove).

621.396.69 **1895**

A Review of the Radio Component Industry's Activities.—E. M. Lee. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 11, pp. 221–230: summary, *ibid.*, Part I, Oct. 1947, Vol. 94, No. 82, pp. 487–488.) History of development, production and standardization work from 1934 to 1947, with an estimate of the post-war value of war-time experience in component production.

621.396.69 : 06.064 **1896**

R.C.M.F. [Radio Component Manufacturers' Federation] **Exhibition.**—(*Elect. Times*, 4th March 1948, Vol. 113, No. 2939, pp. 283–284: *Electrician*, 5th March 1948, Vol. 140, No. 3638, p. 722.) A short account of the opening ceremony and of some of the exhibits.

621.396.69 : 06.064 **1897**

The International Components Exhibition [Paris, Feb. 1948].—G. Sequeille. (*Télévis. franç.*, March 1948, No. 35, pp. 16–18.) A general discussion of the exhibits. The exhibition was international only in name. Another account in *Onde élect.*, March 1948, Vol. 28, No. 252, pp. 115–118; see also 1898 below.

621.396.69 : 06.064 Paris **1898**

Components Exhibition, Paris, 1948.—(*Radio prof., Paris*, Feb. 1948, Vol. 17, No. 159, pp. 18–21 . . 26.) A review of the exhibits, with a short account of the special features of items of particular interest or novelty. For other accounts, see *Toute la Radio*, March/April 1948, Vol. 15, No. 124, pp. 112–115, and 1897 above.

621.396.69 : 389.6 **1899**

Standardization of Components in France.—Radionyme. (*Toute la Radio*, Feb. 1948, Vol. 15, No. 123, pp. 85–88.) Discussion of proposals for standard tests for the various components used in radio receivers and similar apparatus, to ensure good quality.

621.396.69 : 623.6 **1900**

Component Development for War-Time Service Applications.—I. M. Ross. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 11, pp. 231–243: summary, *ibid.*, Part I, Oct. 1947, Vol. 94, No. 82, pp. 493–494.) Discussion of coordination arrangements and organization, and of reliability, miniaturization, tropicalization and other special factors influencing design. Important developments in individual classes and types of components are considered, and future trends and some of the problems still unsolved are briefly reviewed.

621.396.813 : 621.392.015.3 **1901**

Phase and Amplitude Distortion in Linear Networks.—M. J. Di Toro. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1948, Vol. 36, No. 1, pp. 24–36.) The behaviour of practical communication networks is examined and relations are deduced which show the conditions necessary to avoid transient response overshoot caused by phase distortion. Graphs are given from which design data such as transient overshoot and effective bandwidth of networks in cascade may be obtained. Applications to delay lines with lumped and distributed constants, a stagger-tuned i.f. amplifier, and uncompensated and series-peaked compensated video amplifiers are given.

GENERAL PHYSICS

537.52 **1902**

Theory of High Frequency Gas Discharges : Part 1 — Methods for calculating Electron Distribution Functions.—H. Margenau. (*Phys. Rev.*, 15th Feb. 1948, Vol. 73, No. 4, pp. 297–308.)

537.52 **1903**

Theory of High Frequency Gas Discharges : Part 2 — Harmonic Components of the Distribution Function.—H. Margenau & L. M. Hartman. (*Phys. Rev.*, 15th Feb. 1948, Vol. 73, No. 4, pp. 309–315.)

537.52 **1904**

Theory of High Frequency Gas Discharges : Part 3 — High Frequency Breakdown.—L. M. Hartman. (*Phys. Rev.*, 15th Feb. 1948, Vol. 73, No. 4, pp. 316–325.)

537.52 **1905**

Theory of High Frequency Gas Discharges : Part 4 — Note on the Similarity Principle.—H. Margenau. (*Phys. Rev.*, 15th Feb. 1948, Vol. 73, No. 4, pp. 326–328.)

537.525 **1906**

Starting Potentials of High-Frequency Gas Discharges at Low Pressure.—E. W. B. Gill & A. von Engel. (*Proc. roy. Soc. A*, 18th Feb. 1948, Vol. 192, No. 1030, pp. 446–463.) A study of h.f. electrodeless discharges in H, He, air, and Hg vapour at pressures of the order of 10^{-3} mm Hg. The starting field strength is found to be independent of the gas and only slightly dependent on the pressure. As the wavelength is increased from 4 m, the starting field first varies as λ^{-1}, then becomes constant, and at a critical value rises discontinuously, probably to infinity. The cut-off wavelength depends on the size of the containing vessel. A theory based on secondary emission from the glass walls agrees well with the experimental results.

537.533 : 621.385.032.216 **1907**

A Method of Studying the Thermionic Emission of Oxide-Coated Cathodes in Gaseous Conduction Devices.—W. F. Hodge. (*Phys. Rev.*, 1st Jan. 1948, Vol. 73, No. 1, p. 95.) Summary of Amer. Phys. Soc. paper.

537.56 : 621.385.1.016.4.029.63 **1908**

Production of High-Frequency Energy by Ionized Gases.—J. L. Steinberg. (*Nature, Lond.*, 13th Dec. 1947, Vol. 160, No. 4076, pp. 833–834.) A description of measurements made for λ 1.30–2.60 m using a cold cathode discharge in pure nitrogen. The effects of applying a transverse magnetic field across chosen portions of the discharge path are discussed. A complete account is to be published in *Rev. sci., Paris*. See also 715 of 1947 (Thonemann & King).

538.3 **1909**

The Experimental Basis of Electromagnetism : Part 2 — Electrostatics.—N. R. Campbell & L. Hartshorn. (*Proc. phys. Soc.*, 1st Jan. 1948, Vol. 60, No. 337, pp. 27–52.) Continuation of 3091 of 1947. The basis of electrostatics is found in alternating currents and the laws of capacitance which lead to the concept of electric potential energy. The experiments on mechanical forces between electrified bodies fit in with this conception. The soundest procedure in the investigation of any system of conductors and dielectrics is to represent the system by its equivalent capacitance network.

This method is applied to such problems as the measurement of mutual capacitance, the effect of screening and the properties of a complex capacitor.

538.311 + 538.32] : 621.396.67 **1910**

Currents excited on a Conducting Plane by a Parallel Dipole.—B. C. Dunn, Jr, & R. King. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1948, Vol. 36, No. 2, pp. 221–229.) An analysis of the distribution of magnetic field and of current on the plane surface of a perfectly conducting infinite sheet, due to a driven half-wave dipole parallel to the sheet. With certain assumptions regarding current distribution in the dipole, it is found that the tangential magnetic field is everywhere perpendicular to the axis of the dipole while the current is everywhere parallel to this axis. The distributions of field and current are presented graphically and the assumptions regarding current distribution are discussed and shown to be substantially correct for the usual physical systems.

538.569.4.029.64 **1911**

Ultra-Short Waves in the Millimetre Region.—H. H. Klinger. (*Funk u. Ton*, March 1948, No. 3, pp. 135–139.) A review of the special properties of mm waves, including their absorption by water vapour, hydrogen and oxygen. Some possible applications are examined.

538.569.4.029.64 + 537.226.2] : 546.212 **1912**

The Anomalous Dispersion of Water at Very High Radio Frequencies : Part 1 — Experimental Determination of the Dielectric Properties of Water in the Temperature Range 0° C to 40° C for Wave-Lengths of 1.24 cm and 1.58 cm.—J. A. Saxton & J. A. Lane. (*Physical Society Special Report on Meteorological Factors in Radio Wave Propagation*, pp. 278–292.) A free-wave method of determining the refractive index and absorption coefficient of water by measuring the reflection coefficient of a thin film and the attenuation of e.m. radiation passing through it. For λ 1.24 cm, the absorption coefficient increases for 2.11 at 40°C to a maximum of 2.92 at 10°C and then falls to 2.73 at 0°C ; the refractive index decreases steadily from 7.47 at 40°C to 4.67 at 0°C. For λ 1.58 cm, the absorption coefficient increases from 1.80 at 40°C, to a maximum of 2.97 at 5°C and falls to 2.90 at 0°C ; the refractive index decreases steadily from 7.81 to 40°C to 5.24 at 0°C. Similar results are obtained for sea water. Accuracy is within about 1% for the absorption coefficient and about 2% for the refractive index. Evidence is given of anomalous dispersion due to permanent polarity of the molecules. The results are in qualitative agreement with Debye's theory. See also 1913–1915 below.

538.569.4.029.64 + 537.226.2] : 546.212 **1913**

The Anomalous Dispersion of Water at Very High Radio Frequencies : Part 2 — Relation of Experimental Observations to Theory.—J. A. Saxton. (*Physical Society Special Report on Meteorological Factors in Radio Wave Propagation*, pp. 292–306.) Recent theories of the dielectric constant of a pure polar liquid are discussed. The Debye theory as modified by Onsager is used as a basis for the examination of the relation to theory of the measurements described in 1912 above. The form of the equations is verified ; the results compare well with existing data on wavelengths up to 10 cm, but a higher value of atomic polarization ($\epsilon_0 \simeq 5.5$) must be assumed than has hitherto been used.

Curves are calculated on this basis to show the variation of dielectric properties for λ 0.2–10 cm and for temperatures of 0°–40°C. The relaxation time and atomic polarization are discussed, and the relation between relaxation time and viscosity is briefly examined.

538.569.4.029.64 + 537.226.2] : 546.212 **1914**

The Anomalous Dispersion of Water at Very High Radio Frequencies : Part 3 — The Dipole Relaxation Time and Its Relation to the Viscosity.—J. A. Saxton. (*Physical Society Special Report on Meteorological Factors in Radio Wave Propagation*, pp. 306–316.) The experimental results described in 1912 above are examined on the basis of Eyring's theory of absolute reaction rates. A fundamental similarity exists between the mechanisms of dipole rotation and viscous flow, and the dielectric properties under consideration can be determined from a knowledge of the viscosity, the atomic polarization and static dielectric constant. A single relaxation time, dependent on temperature, seems adequate to account for dipolar dispersion in water.

1915

538.569.4.029.64 + 537.226.2] : [546.331.31 + 546.212

The Anomalous Dispersion of Water at Very High Radio Frequencies : Part 4 — A Note on the Effect of Salt in Solution.—J. A. Saxton. (*Physical Society Special Report on Meteorological Factors in Radio Wave Propagation*, pp. 316–325.) The dielectric properties of an aqueous salt solution at v.h.f. are in agreement with the supposition that the salt produces a structural change in the water analogous to that produced by an increase in temperature. Calculations, based on this hypothesis and actual absorption measurements, have been made of the dielectric properties of solutions for other wavelengths, and they agree well with experimental determinations.

538.569.4.029.64 : 546.171.1 **1916**

Pressure Broadening of the Inversion Spectrum of Ammonia : Part 2 — Disturbance of Thermal Equilibrium at Low Pressures.—B. Bleaney & R. P. Penrose. (*Proc. phys. Soc.*, 1st Jan. 1948, Vol. 60, No. 337, pp. 83–98.) The absorption coefficient at the centre of the line (3,3) of the centimetre wavelength inversion spectrum of ammonia gas was measured at pressures between 1.5 and 0.01 mm Hg. The coefficient is constant at the higher pressures, as would be expected for a single line whose width is determined solely by pressure broadening. At lower pressures, the absorption coefficient falls by an amount dependent on the energy density in the resonator. This is due to disturbance of thermal equilibrium by absorption of r.f. energy. A theory is developed from which the thermal relaxation time can be calculated by comparison with experimental values of the absorption coefficient. See also 3507 and 3870 of 1947.

530.145 **1917**

The Principles of Quantum Mechanics. [Book Review] —P.A.M. Dirac. International Series of Monographs on Physics, Clarendon Press, Oxford & Oxford University Press, London, 3rd edn 1947, 312 pp., 25s. (*Nature, Lond.*, 13th Dec. 1947, Vol. 160, No. 4076, p. 812.) The book "is the standard work in the fundamental principles of quantum mechanics, indispensable both to the advanced student and the mature research worker".

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

016 : 550.38 **1918**

List of Recent Publications [on terrestrial and cosmic electricity and magnetism, and allied subjects].—H. D. Harradon. (*Terr. Magn. atmos. Elect.*, Dec. 1947, Vol. 52, No. 4, pp. 558–565.)

523.7 + 550.385] "1947.04/.09" **1919**

Solar and Magnetic Data, April to September, 1947, Mount Wilson Observatory.—S. B. Nicholson. (*Terr. Magn. atmos. Elect.*, Dec. 1947, Vol. 52, No. 4, pp. 451–452.)

523.72.029.6 : 621.396.822 **1920**

Metre and Centimetre Waves from the Sun.—K. O. Kiepenheuer. (*Funk u. Ton*, April 1948, No. 4, pp. 165–170.) A general discussion of the correlation between s.w. radiation from the sun and the occurrence of sunspots, flares, etc., and of the magnitude of the solar temperatures and magnetic fields which would account for the observed effects.

523.72.029.63"1946.06/1947.05" **1921**

Solar Intensity at 480 Mc/s.—G. Reber. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1948, Vol. 36, No. 1, p. 88.) Noon solar intensity values obtained at Wheaton, Illinois, are plotted for June 1946–May 1947 and discussed.

523.746"1946" **1922**

Final Relative Sunspot-Numbers for 1946.—M. Waldmeier. (*Terr. Magn. atmos. Elect.*, Dec. 1947, Vol. 52, No. 4, pp. 493–495.)

523.746"1947.07/.09" **1923**

Provisional Sunspot-Numbers for July to September, 1947.—M. Waldmeier. (*Terr. Magn. atmos. Elect.*, Dec. 1947, Vol. 52, No. 4, p. 448.)

523.78 "1940.10.01" : 551.510.535 **1924**

The Ionospheric Eclipse of October 1, 1940.—J. A. Pierce. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1948, Vol. 36, No. 1, pp. 8–15.) Values of critical frequencies, obtained for the various layers during the total eclipse at Queenstown, South Africa, are discussed and compared with observations made under normal conditions. A theory of the formation of the E layer is proposed to account for some of the results. Processes of recombination and diffusion cannot explain completely the behaviour of the F_2 region ; cooling of the atmosphere as a result of the eclipse probably plays an important part. Some of the results are compared with those obtained in the U.S.S.R. in 1936. The Russian results were not published as it was thought that a severe magnetic storm might have made them unreliable.

523.78"1945.07.09" : 551.510.535 **1925**

Some Experimental Results obtained by Ionospheric Investigations in Sweden during the Total Solar Eclipse of July 9, 1945.—S. Gejer & P. Åkerlind. (*Terr. Magn. atmos. Elect.*, Dec. 1947, Vol. 52, No. 4, pp. 479–491.) The critical frequencies were measured during the eclipse and on several days before and after it. The greatest decreases in the ionization densities for the E, F, and F_2 regions were respectively 57%, 63%, and 33% below the estimated undisturbed values. During the eclipse, the signal strength of a N. American station on 15 Mc/s fell by about 20 db at totality. The signal strength of two medium-wave Swedish stations showed no important change, indicating that D-region absorption remained high. See also 1777 of 1947 (Rydbeck).

523.854 : 621.396.822.029.62 **1926**

An Investigation of Galactic Radiation in the Radio Spectrum.—J. S. Hey, S. J. Parsons & J. W. Phillips. (*Proc. roy. Soc. A*, 18th Feb. 1948, Vol. 192, No. 1030, pp. 425–445.) An investigation of the distribution of the sources of galactic radiation at 64 Mc/s is described. Methods are discussed for measuring the characteristics of the receiving aerial and estimating the magnitude of the received galactic power by reference to the noise from a saturated diode. Possible sources of error are considered ; an accuracy better than 1.2 db (30%) is expected for the regions of highest radiation intensity. Comparison of the derived distributions of galactic radiation with other astronomical data does not clearly favour any one theory. Neither a simple theory in terms of a distributed source in interstellar gas nor one in terms of discrete centres of radiation analogous to sunspots appears adequate to account for the observed phenomena. It is suggested that sources of both types contribute to the observed radiation and that, in general, they must be very distant and associated with the main body of the galaxy. See also 402 and 3511 of 1947, and 413 of February.

538.12 : 521.15 **1927**

On Magnetism of Celestial Bodies.—J. Mariani. (*Phys. Rev.*, 1st Jan. 1948, Vol. 73, No. 1, pp. 78–79.) An interpretation of the proportionality of magnetic moment to angular momentum in the case of celestial bodies is suggested. The electrical density is found to be of the order assumed by Blackett (3112 of 1947) for the production of cosmic magnetism. Also, the charge associated with the gravitational field energy is of the same order as the negative charge at the earth's surface. See also 2115 of 1947, 1634 and 1635 of June and back references.

550.38 (515) **1928**

Preliminary Report on the Magnetic Results of a Journey to Sikkim and Southern Tibet.—K. Wienert. (*Terr. Magn. atmos. Elect.*, Dec. 1947, Vol. 52, No. 4, pp. 505–521.) The declination, horizontal intensity, and dip for 55 stations in the area, reduced to the epoch 1939.0, are tabulated. Methods of reduction and apparatus used are discussed.

550.38"1946" **1929**

Mean *K*-Indices from Thirty Magnetic Observatories and Preliminary International Character-Figures, *C*, for 1946.—W. E. Scott. (*Terr. Magn. atmos. Elect.*, Dec. 1947, Vol. 52, No. 4, pp. 497–503.)

550.38"1947.07/.09" **1930**

Cheltenham [Maryland] ***K*-Indices for July to September, 1947.**—W. E. Wiles. (*Terr. Magn. atmos. Elect.*, Dec. 1947, Vol. 52, No. 4, p. 522.)

550.38 "1947.07/.09" **1931**

***K*-Indices and Sudden Commencements, July to September, 1947, at Abinger.**—H. Spencer Jones. (*Terr. Magn. atmos. Elect.*, Dec. 1947, Vol. 52, No. 4, pp. 495–496.)

550.384 **1932**

Note on 'Sudden Commencements' and Other Small Characteristic Impulses [of the earth's field].—H. W. Newton. (*Terr. Magn. atmos. Elect.*, Dec. 1947, Vol. 52, No. 4, pp. 441–447.) The close correspondence in time and character of certain impulses recorded in England and N. America is mentioned. Tracings are included for comparison in other countries.

550.384.3 (498) **1933**

Magnetic Measurements at Jassy from 1941 to 1947.—S. Procopiu. (*Bull. Éc. polyt. Jassy*, July/Dec. 1947, Vol. 2, No. 2, pp. 193–196. In French.) Tables of D and H.

550.384.3 (498) **1934**

Magnetic Measurements at Jassy from 1941 to 1947.—N. Calinicenco. (*Bull. Éc. polyt. Jassy*, July/Dec. 1947, Vol. 2, No. 2, pp. 197–199. In French.) Tables of the magnetic inclination I.

550.384.3 (498) **1935**

Values of the Magnetic Elements and Secular Variations at Jassy, during 16 Years, from 1931 to 1947.—S. Procopiu. (*Bull. Éc. polyt. Jassy*, July/Dec. 1947, Vol. 2, No. 2, pp. 207–220. In French.) Tables, for 1st July in each year, of D, H and I, dD, dH and dI, also of Z and F. The variations at Bucharest and at Jassy from 1772 to 1947 are shown graphically and discussed.

550.384.4 **1936**

The Magnetic Diurnal Variation of the Horizontal Force near the Magnetic Equator.—J. Egedal. (*Terr. Magn. atmos. Elect.*, Dec. 1947, Vol. 52, No. 4, pp. 449–451.) If ΔH is plotted against magnetic inclination for stations near the equator, a smooth curve can be drawn which passes through the points for Kodaikanal and Huancayo. The curve is discussed briefly.

550.385 "1947.07/.09" **1937**

Principal Magnetic Storms [July–Sept. 1947].—(*Terr. Magn. atmos. Elect.*, Dec. 1947, Vol. 52, No. 4, pp. 540–557.)

551.510.5 : 525.624 **1938**

Atmospheric Oscillations and the Resonance Theory.—K. Weekes & M. V. Wilkes. (*Proc. roy. Soc. A*, 23rd Dec. 1947, Vol. 192, No. 1028, pp. 80–99.) A description of the circumstances under which tidal energy supplied to the atmosphere through the action of tide-producing forces can be trapped between a certain stratum (usually where the temperature has a minimum) and the ground. The results are applied to discuss in general terms the types of free oscillation which an atmosphere with a given temperature distribution may possess. Results of numerical calculations are given which determine to what extent the requirements of the resonance theory restrict the possible temperature variation in the atmosphere.

551.510.52 : 621.396.11 **1939**

The Structure and Refractive Index of the Lower Atmosphere.—P. A. Sheppard. (*Physical Society Special Report on Meteorological Factors in Radio Wave Propagation*, pp. 37–79.) Data on the vertical gradients of temperature and humidity in the lowest kilometre of atmosphere, which largely determine the gradient of the refractive index, are assembled and discussed. Profiles measured over land and sea are examined in detail with reference to diurnal and seasonal effects, advection and subsidence. The effect of turbulence on these profiles in certain conditions is briefly discussed.

551.510.52 : 621.396.11 **1940**

Refraction in the Lower Atmosphere and Its Applications to the Propagation of Radio Waves.—A. C. Stickland. (*Physical Society Special Report on Meteorological Factors in Radio Wave Propagation*, pp. 253–267.) The variation with height of the refractive index of the lower atmosphere is studied from available meteorological data, and a law is deduced for the average bending of short radio waves by the atmosphere. Empirical formulae for the variation of refractive index with height are examined; world-wide variations are also considered. Finally, the application of the results to propagation problems is discussed.

551.510.52 : 621.396.11 **1941**

Note on Errors in Measurement of the Refractive Index of the Air for High-Frequency Radio Waves consequent upon Errors in Meteorological Measurements.—G. A. Bull. (*Physical Society Special Report on Meteorological Factors in Radio Wave Propagation*, pp. 273–278.)

551.510.52 : 621.396.11 **1942**

A Standard Radio Atmosphere for Microwave Propagation.—Best. (*See* 2045.)

551.510.52 : 621.396.812 **1943**

Radio Climatology.—C. S. Durst. (*Physical Society Special Report on Meteorological Factors in Radio Wave Propagation*, pp. 193–212.) "Meteorological conditions as regards temperatures and humidity are examined for certain regions of the globe in certain seasons. These conditions are related to the occurrence of abnormal refraction of radio waves. From this examination it is shown how the regions of abnormal refraction can be mapped for much of the world, provided maps are available of (*a*) the contrast of sea and air temperature, (*b*) humidity, (*c*) horizontal air flow near the surface, and (*d*) vertical air flow at some comparatively low height."

551.510.53 : 537.591.8 **1944**

The Basic Reactions in the Upper Atmosphere: Part 2 — The Theory of Recombination in the Ionized Layers.—D. R. Bates & H. S. W. Massey. (*Proc. roy. Soc. A*, 23rd Dec. 1947, Vol. 192, No. 1028, pp. 1–16.) The results of recent work make the ionic recombination theory very difficult to maintain. Two possible alternatives are here discussed, the dust recombination theory and the molecular recombination theory. It is concluded that only the second of these is at all promising. According to this theory non-radiative combination of an electron with a molecular positive ion can occur, the energy released by the capture producing dissociation of the oxygen molecule. Confirmation of the theory must await proper determination of the appropriate reaction rates, but the modified molecular recombination theory appears capable of giving a plausible explanation of the ionized layers. Part 1: 414 of 1947.

551.510.535 + 550.385 **1945**

Differential Penetration and Magnetic Storms.—T. L. Eckersley. (*Terr. Magn. atmos. Elect.*, Dec. 1947, Vol. 52, No. 4, pp. 433–440.) Magnetic and ionospheric storms are attributed to neutral streams of charged particles which enter the earth's field; the behaviour of such streams has been examined (726 of March). The observed increase in abnormal-E is due to penetration of positive particles to the E region; the negative particles do not penetrate below the F region, where they drift westward, causing the observed increase in H and decrease in F-region ionization density.

551.510.535 **1946**

On the Measurement of Ionospheric Virtual Height at 100 Kilocycles.—R. A. Helliwell. (*Phys. Rev.*, 1st Jan. 1948, Vol. 73, No. 1, p. 77.) An aerial is charged to 100 kV and allowed to discharge through a sphere gap. About 500 W is radiated vertically in pulses of time constant 200 μs. At night in October 1947 in California, reflections were obtained from virtual heights of 91–98 km. These echoes were sometimes weaker than the first-order multiple reflections.

551.510.535 : 621.396.11 **1947**

On Magneto-Ionic Splitting [of radio waves] **in the Sporadic E Layer.**—Driatski. (*See* 2051.)

551.510.535 : 621.396.11 **1948**

The Influence of Wave-Propagation on the Planning of Short-Wave Communication.—Tremellen & Cox. (*See* 2050.)

551.510.535 : 621.396.11 **1949**

The Investigation and Forecasting of Ionospheric Conditions.—Appleton. (*See* 2048.)

551.510.535 : 621.396.11 **1950**

Developments in Radio Sky-Wave Propagation Research and Applications during the War.—Dellinger & Smith. (*See* 2049.)

551.594.21 **1951**

On the Electricity of Thunderstorms.—V. I. Arabadzhi. (*Priroda*, 1947, No. 7, pp. 12–15. In Russian.) Various theories of the electrification of clouds are surveyed and preference is given to the contact theory as originally expounded by Luvini and Sohnke.

551.594.5 **1952**

A Proposed Auroral Index-Figure.—I. L. Thomsen. (*Terr. Magn. atmos. Elect.*, Dec. 1947, Vol. 52, No. 4, pp. 453–467.) A new numerical scale with 15 degrees of intensity is proposed, and compared with existing scales. Auroral form or activity as well as brightness is considered in determining the new scale number.

551.594.5 **1953**

Notes on the Aurora Australis.—I. L. Thomsen. (*Terr. Magn. atmos. Elect.*, Dec. 1947, Vol. 52, No. 4, pp. 469–477.) Continuous records of aurora seen in New Zealand for nearly 1½ sunspot cycles are available at the Carter Observatory. Auroral phenomena in the southern hemisphere are believed to be generally similar to those of the northern, but scientifically reliable data are scanty.

523.746 **1954**

Sunspots in Action. [Book Review]—H. T. Stetson. Ronald Press Co., New York, 1947, 227 pp., $3.50. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1948, Vol. 36, No. 2, p. 254.) ". . Collects into a highly informative and thoroughly readable form a wealth of information covering various aspects of sunspot phenomena."

LOCATION AND AIDS TO NAVIGATION

621.396.93 **1955**

Fundamental Problems in Radio Direction-Finding at High Frequencies (3-30 Mc/s).—W. Ross. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 11, pp. 154–165: summary, *ibid.*, Part I, Oct. 1947, Vol. 94, No. 82, pp. 479–480.) A survey paper that discusses instruments and propagation. Wave interference effects from two rays arriving from different directions may give rise to considerable errors for systems of the Adcock type in which the aerial spacing is comparable with λ. Wide spacing of the aerials eliminates interference but may give ambiguous bearings. Various forms of display are discussed and the specification of the performance of the Adcock type direction finder is considered. The directions of propagation of ground and ionospheric waves are examined and a summary is given of the present knowledge of deviations of ionospheric rays from the great-circle path and of methods developed to overcome this. Methods of assessing the probable accuracy of individual bearings are discussed, though there is still no fully satisfactory solution; the determination of the most probable transmitter location is also considered. Possible future development of mechanical and electronic devices for carrying out the necessary operations automatically are mentioned.

621.396.932.2 **1956**

Naval Radio Direction-Finding.—C. Crampton. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 11, pp. 132–153: summary, *ibid.*, Part I, Oct. 1947, Vol. 94, No. 82, pp. 477–478.) A brief account of land-based d.f. systems used by the Admiralty and of the German Wullenweber steerable-lobe system.

Shipborne systems for m.f., h.f. and v.h.f. are described, with particular attention to the position of the aerial system for optimum accuracy. The effect of reradiation by various structures is considered in detail and curves for estimating the probable errors are given, together with typical calibration curves for h.f. and v.h.f. systems. The sensitivity of a crossed-loop h.f. system is examined; the probable range of a transmitter may be estimated from the strength of the signal received. Curves are given showing how a spaced-loop system can give increased accuracy at h.f.

621.396.933 + 621.396.96 **1957**

Radar Equipment manufactured in Hungary and Abroad.—E. Istvánffy. (*Elektrotechnika, Budapest*, Jan. 1948, Vol. 40, No. 1, pp. 1–12.) A review of wartime developments, including British and American types and a few navigation systems.

621.396.933 **1958**

The Development of C.W. Radio Navigation Aids, with Particular Reference to Long-Range Operation.—R. V. Whelpton & P. G. Redgment. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 11, pp. 244–254: summary, *ibid.*, Part I, Oct. 1947, Vol. 94, No. 82, pp. 489–490.) Considerations governing the choice of system and the selection of optimum frequency in relation to reliability and range, with some details of various methods involving phase or amplitude measurement, and discussion of their relative merits. Pulse techniques are only briefly reviewed.

621.396.933 **1959**

Radar Navigation.—R. A. Smith. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, pp. 331–342.) Full paper: summary noted in 3144 of 1947.

621.396.933 **1960**

A Survey of Continuous-Wave Short-Distance Navigation and Landing Aids for Aircraft.—C. Williams. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 11, pp. 255–266: summary, *ibid.*, Part I, Oct. 1947, Vol. 94, No. 82, pp. 491–492.) Requirements for navigation and landing aids are discussed and the importance of the method of display of information is stressed. Principal features of several different types of system are briefly described. Principles and applications of radio altimeters, and methods of distance measurement, are also considered.

621.396.933 **1961**

Radio and Aerial Navigation in Civil Aviation.—F. Penin. (*Onde élect.*, March 1948, Vol. 28, No. 252, pp. 87–98.) Discussion of general problems and short descriptions of various navigational systems.

621.396.96 **1962**

Precision Radar.—W. A. S. Butement, B. Newsam & A. J. Oxford. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, pp. 114–126.) Measurements of ranges up to 20 miles were required to an overall accuracy of ± 25 yd. Pulse technique was used; the leading edge of an echo was found the most satisfactory as a ranging point. The necessary accuracy in frequency was achieved by means of crystal-controlled valve oscillators. For high accuracy in measuring angles, narrow split beams were used; this technique is discussed fully. Calibration, sources of error and possible future developments are considered; three typical equipments are briefly described.

621.396.96 : 551.594.6 **1963**

Radar Storm Detection: Part 1.—F. L. Westwater. (*Physical Society Special Report on Meteorological Factors in Radio Wave Propagation*, p. 190.) Brief discussion, with photographs, of typical echoes. For theory see 2062 below.

621.396.96 : 551.594.6 **1964**

Radar Storm Detection: Part 2.—R. G. Ross. (*Physical Society Special Report on Meteorological Factors in Radio Wave Propagation*, pp. 190–193.) Brief discussion, with illustrative example, of the use of radar storm observations for short-term local weather forecasting.

621.396.96 : 621.385.832 **1965**

The Visibility of Small Echoes on Radar PPI Displays.—R. Payne-Scott. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1948, Vol. 36, No. 2, pp. 180–196.) A discussion of the mathematical basis of visibility on a c.r. tube p.p.i. display, with experimental confirmation and nomograms for the rapid calculation of the minimum visible signal under any set of conditions.

621.396.96 : 621.392 **1966**

Introduction to Circuit Techniques for Radiolocation.—Williams. (*See* 1874.)

621.396.96 : 621.396.61 **1967**

Radar Transmitters: A Survey of Developments.—Ratsey. (*See* 2095.)

621.396.96 : 621.396.621 **1968**

Radar Receivers.—Lewis. (*See* 2067.)

621.396.96 : 621.396.812(931) **1969**

Observations of Unorthodox Radar Vision in the Vicinity of New Zealand and Norfolk Island.—F. E. S. Alexander. (*Physical Society Special Report on*

Meteorological Factors in Radio Wave Propagation, pp. 242–249.) Observations based on records of war-time operational stations. [*Note.* More recently a scientific expedition was sent to study propagation and meteorological conditions in the Christchurch district, but results have not yet been published.]

621.396.96 : 621.396.812.029.64 **1970**

The Attenuation and Radar Echoes produced at Centimetre Wave-Lengths by Various Meteorological Phenomena.—Ryde. (*See* 2062.)

621.396.96 : 621.396.932 **1971**

Problems in Shipborne Radar.—A. W. Ross. (*J. Instn elect. Engrs,* Part IIIA, 1946, Vol. 93, No. 1, pp. 236–244.) Information from any one receiver must be distributed to several positions; displays must be interchangeable, and often well separated from the set; there may be up to 30 radar sets in addition to many communications equipments in a ship; stabilization to compensate for the motion of the ship must be arranged; side lobes must be very small; sea clutter effects, transmitter instability due to long aerial feeders, and interference effects must be reduced to a minimum; reliability and ease of maintenance are important considerations. Methods of meeting these requirements as far as possible are discussed. The design of shipborne navigation aids is also briefly considered.

MATERIALS AND SUBSIDIARY TECHNIQUES

533.5 : 621.3.032.53 **1972**

New Techniques in Glass-to-Metal Sealing.—J. A. Pask. (*Proc. Inst. Radio Engrs, W. & E.,* Feb. 1948, Vol. 36, No. 2, pp. 286–289.) The new techniques enable seals to be made by controlled processes on a mass-production basis. The metal is first oxidized to obtain a film of a definite thickness. The glass is powdered, applied to the surface as a suspension in a liquid, and finally fused. Other additions can then be made by glass-to-glass seals. Critical factors in the process are defined, and theories of the baking, adhering and oxidation processes are suggested.

535.37.001.8 **1973**

Applications of Luminescent Substances.—F. A. Kröger. (*Philips tech. Rev.,* 1947, Vol. 9, No. 7, pp. 215–221.) A general discussion of the most suitable luminescent substances for use with electron beams, X rays, ultra-violet rays, and infra-red rays.

538.221 **1974**

The Theory of the Ferromagnetism of Binary Alloys.—S. V. Vonsovski. (*Zh. tekh. Fiz.,* Feb. 1948, Vol. 18, No. 2, pp. 131–144. In Russian.)

538.221 : 669.14 **1975**

Magnetic Properties of Cr-Ni-Mo Steel after Various Thermal Treatments.—P. N. Zhukova & M. N. Mikheev. (*Zh. tekh. Fiz.,* Feb. 1948, Vol. 18, No. 2, pp. 187–196. In Russian.)

546.161-1 : 621.3.015.5 **1976**

Gaseous Insulation for High-Voltage Apparatus.—G. Camilli & J. J. Chapman. (*Gen. elect. Rev.,* Feb. 1948, Vol. 51, No. 2, pp. 35–41.) Description of an investigation of a group of halogenated gaseous compounds to determine their impulse ($1\frac{1}{2} \times 40$ microsecond wave) and 60-c/s alternating voltage strength in uniform and non-uniform fields at pressures of one, two and three atmospheres.

Results show that SF_6 is superior to the freon gases. It reaches a dielectric strength comparable to that of mineral oil, at pressures low enough to prevent the gas from condensing over the expected ambient temperature range. SF_6 is stable at high temperatures and non-inflammable. As no carbon is contained in its molecular structure, it does not leave a conducting deposit after slight decomposition by breakdown.

621.3.017.22 **1977**

Investigation of the Eddy-Current Anomaly in Electrical Sheet Steels.—F. Brailsford. (*J. Instn elect. Engrs,* Part II, Feb. 1948, Vol. 95, No. 43, pp. 38–48.)

621.3.042.2 **1978**

The Effects of Overlapping Joints in Laminated Magnetic Cores on the M.M.F. and Power required for Their A.C. Magnetization.—O. I. Butler & C. Y. Mang. (*J. Instn elect. Engrs,* Part II, Feb. 1948, Vol. 95, No. 43, pp. 15–24.)

621.3.042.2 : 621.317.4 **1979**

The Predetermination of the Magnetic Properties of Ferromagnetic Laminae at Power and Audio Frequencies.—O. I. Butler & C. Y. Mang. (*J. Instn elect. Engrs,* Part II, Feb. 1948, Vol. 95, No. 43, pp. 25–37.)

621.315.61 **1980**

Work Function and Energy Levels in Insulators.—D. A. Wright. (*Proc. phys. Soc.,* 1st Jan. 1948, Vol. 60, No. 337, pp. 13–22.) "An estimate is made for several insulators of the energies of the highest filled energy band and of the empty conduction band. For BaO, SrO, CaO, MgO and BeO, the bottom of the conduction band is near the zero level. It is considerably lower in AgBr, ZnO and ZnS. The bearing of the results on thermionic emission, secondary emission and photoconductivity is briefly discussed, with special reference to BaO and SrO." See also 1981 below.

621.315.61 : 621.3.032.216 **1981**

Energy Levels in Oxide Cathode Coatings.—D. A. Wright. (*Proc. phys. Soc.,* 1st Jan. 1948, Vol. 60, No. 337, pp. 22–27.) The energy level diagram is considered in the case of a Ba/SrO emissive cathode coating, and it is concluded from the results of the paper noted in 1980 above that the process of activation consists in building up a concentration of free barium in the coating, and in providing barium at the interface between core and coating. The work function of the activated coating without adsorbed barium on its outer surface cannot be much greater than the observed value of 1 eV, and may be no greater, so that such an adsorbed layer, if present, has only a small effect on the work function. The possibility of increase in emission under the influence of ultra-violet light or electron bombardment is briefly discussed.

621.316.993 **1982**

The High-Voltage Characteristics of Earth Resistances.—G. M. Petropoulos. (*J. Instn elect. Engrs,* Part II, Feb. 1948, Vol. 95, No. 43, pp. 59–70.)

621.318.22 **1983**

The Effect of Rust and Recrystallization on the Magnetic Properties of Soft Magnetic Materials.—V. I. Drozhzhina, M. G. Luzhinskaya & Ya. S. Shur. (*Zh. tekh. Fiz.,* Feb. 1948, Vol. 18, No. 2, pp. 167–174. In Russian.)

621.318.322 **1984**

The Effect of Heat Treatment on the Shape of Magnetization and Magnetostriction Curves of Alsifer Alloys.—Ya. S. Shur & A. A. Lukshin. (*C. R. Acad. Sci. U.R.S.S.,* 1st Feb. 1948, Vol. 59, No. 4, pp. 693–695. In Russian.)

669.717 : 621.315.22 **1985**

Aluminium-Sheathed Cables.—(*Elect. Rev., Lond.,* 23rd April 1948, Vol. 142, No. 3674, pp. 629–630.) Some details of the manufacturing process and illustrations of joints. The light-weight sheath is far superior to any lead alloy in tensile strength and resistance to creep and is better able to endure fatigue and vibration. The higher permissible service temperatures for Al-sheathed cables may enable Cu-core size to be reduced.

MATHEMATICS

517.564.2 : 518.3 **1986**

Nomograms of Complex Hyperbolic Functions. [Book Review]—J. Rybner. J. Gjellerups Forlag, Copenhagen, 24 kroner. (*Wireless Engr*, April 1948, Vol. 25, No. 295, p. 129.) The text is in both English and Danish.

MEASUREMENTS AND TEST GEAR

531.764 + 621.3.018.4(083.74)] : 621.396.7 **1987**

Centre for the Emission of Standard Frequencies and Time Signals.—A. Pinciroli. (*Alta Frequenza*, Sept. 1944, Vol. 13, No. 3, pp. 150–154. In Italian, with English, French and German summaries.) Discussion of experiments with a view to the creation of such a centre near the Galileo Ferraris National Electrotechnical Institute. The equipment used is briefly described. Negative-transconductance multivibrators are used for frequency division. The rhythmic time signal is obtained by means of a rotating disk furnished with a suitable system of slots through which a beam of light passes to a photocell.

621.317.029.6 **1988**

Ultra-High-Frequency Measurements.—C. W. Oatley. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, pp. 199–206.) A survey paper covering, in general terms only, the techniques of measurements at frequencies exceeding 50 Mc/s. The discussion includes the measurement of frequency, voltage, current, and power at kilowatt and milliwatt levels. Methods of measuring attenuation, impedance, field strength, and aerial gain are also considered.

621.317.083.7 **1989**

Design Principles of Amplitude-Modulated Subcarrier Telemeter Systems.—C. K. Stedman. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1948, Vol. 36, No. 1, pp. 36–41.) The problems of multichannel overload, crosstalk, filter design, and signal/noise ratio are discussed. A new criterion is obtained for multichannel overload which is easy to use and simply related to single-signal overload. Nothing is gained by spacing filter midband frequencies in such a way that harmonics of lower subcarriers fall outside the pass bands of higher-frequency channel filters.

621.317.3.011.5 + 538.569.4.029.64] : 546.212 **1990**

The Anomalous Dispersion of Water at Very High Radio Frequencies : Part 1 — Experimental Determination of the Dielectric Properties of Water in the Temperature Range 0°C to 40°C for Wave-Lengths of 1.24 cm and 1.58 cm.—Saxton & Lane. (*See* 1912.)

621.317.3.011.5 : 621.396.611.4.029.64 **1991**

The Cavity Resonator Method of measuring the Dielectric Constants of Polar Liquids in the Centimetre Band.—C. H. Collie, J. B. Hasted & D. M. Ritson. (*Proc. phys. Soc.*, 1st Jan. 1948, Vol. 60, No. 337, pp. 71–82.) The resonance curve of an H_{01} resonator with an axial capillary of liquid is measured. The value deduced for the refractive index n of water at 21°C is $n = 6.30 \pm 1\%$.

621.317.3.011.5.029.63/.64 **1992**

A Method for the Measurement of the Dielectric Properties of Liquids in the Frequency Range 600-3 200 Mc/s (50-9.4 cm).—R. Dunsmuir & J. G. Powles. (*Phil. Mag.*, Nov. 1946, Vol. 37, No. 274, pp. 747–756.) The liquid is contained in a thin-walled bottle of fused quartz placed inside a cylindrical cavity resonator. The permittivity and power factor of the liquid are obtained from measurements of the resonant frequencies and Q factors of the system. The relevant theory is given.

621.317.3.011.5.029.63/.64 **1993**

On Measurements of the Dielectric Constants of Solid Dielectrics at Centimetre Wavelengths.—A. I. Starobinski. (*Zh. tekh. Fiz.*, Oct. 1947, Vol. 17, No. 10, pp. 1209–1214. In Russian.)

621.317.3.011.5.029.63 **1994**

Dielectric Measurements at Centimetre Wavelengths.—C. N. Smyth & R. G. Roach. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 9, pp. 1462–1466 : summary, *ibid.*, Part IIIA, 1946, Vol. 93, No. 1, pp. 232–233.) Design principles are discussed and coaxial instruments operating in the frequency band 600–3 000 Mc/s are described. With disk samples an accuracy within 1% for permittivity and within 5% for power factor is achieved. For tubular specimens the accuracy is lower—within about 10%—but the variation of dielectric properties with temperature may be examined with such samples.

621.317.3.011.5.029.64 **1995**

Dielectric Measurement at Wavelengths around 1 cm by means of an H_{01} Cylindrical-Cavity Resonator.—J. Lamb. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 9, pp. 1447–1451.) The changes in resonant length and Q factor caused by introducing the specimen are used respectively to derive the permittivity and loss factor. Liquid or solid materials may be examined. The accuracy of the method is discussed and measured values for certain substances are tabulated.

621.317.3.011.5.029.64 : 546.212 **1996**

The Dielectric Properties of Water Vapour at Very High Radio Frequencies.—J. A. Saxton. (*Physical Society Special Report on Meteorological Factors in Radio Wave Propagation*, pp. 215–238.) Measurements of the dielectric constant and absorption coefficient of water vapour by resonant cavity methods. The values of dielectric constant obtained at 76 cm pressure and 100°C are 1.005 6, 1.005 1 and 1.005 6 for 9, 3.2 and 1.6 cm respectively. Comparison with the static value of 1.006 0 shows some evidence of dispersion ; this is discussed. The absorption coefficient at 100°C was greatest for the highest frequency used, its value then being 1.8×10^{-6}. The experimental results are used to estimate the attenuation due to atmospheric water vapour, for u.h.f. propagation through the troposphere. See also 2845 of 1947 (Lamb).

621.317.33/.34].029.64 **1997**

The Two-Point Method of measuring Characteristic Impedance and Attenuation of Cables at 3 000 Mc/s.—W. T. Blackband & D. R. Brown. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 9, pp. 1383–1386.) The cable parameters are measured from two observations of the s.w.r. in a slotted line, under specified conditions. A description of the apparatus is given, together with results of measurements in the frequency band 2 300–3 300 Mc/s. The method is suitable for detecting irregularities in the cable.

621.317.331 : 621.396.611 **1998**

Application of the Falling Characteristic to the Measurement of the Loss- and Resonance-Resistance of Oscillatory Circuits.—H. Frühauf. (*Funk u. Ton*, Feb. 1948, No. 2, pp. 81–87.) A simple method for which no elaborate apparatus is required. Only resistors, capacitors, batteries and a single valve are used, with two moving-coil instruments.

621.317.332.029.64 **1999**

Resistance Comparison at 3 300 Mc/s by a Novel Method.—C. J. Milner & R. B. Clayton. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 9, pp. 1409–1412: summary, *ibid.*, Part IIIA, 1946, Vol. 93, No. 1, pp. 226–227.) The u.h.f. resistance of specimens of wire form is deduced from changes in Q of a $3\lambda/4$ concentric-line resonator in which the specimen forms a $\lambda/2$ section of the inner conductor. The apparatus is calibrated with Cu and Mo specimens of calculated u.h.f. resistance ratio.

Q measurements are made by a novel method in which the resonator is compared with a standard one. Both resonators are coupled to a f.m. oscillator and the difference in output of crystal detectors in the two resonators is displayed on a c.r. tube against the f.m. voltage. A null indication is obtained when a triple balance is secured, (*a*) for resonant frequency, (*b*) for Q, and (*c*) for peak height of the resonance curves.

621.317.335 **2000**

Sensitive Capacitance Measurements with Double-Valve Voltmeter and Voltage Divider.—R. Mecke & R. L. Schupp. (*Funk u. Ton*, April 1948, No. 4, pp. 171–174.) With stabilized supply voltages for the double voltage divider (1075 of April), a sensitivity $\Delta C/C_{max}$ of 3×10^{-6} is possible, using as indicator a mirror galvanometer with sensitivity 10^{-8} A/scale division. When the double-valve voltmeter is used as indicator, the maximum sensitivity with the circuit given is $\Delta C/C_{max} \approx 2 \times 10^{-5}$.

621.317.336 **2001**

On a Method of H.F. Impedance Measurement, using Transmission-line Resonance Curves.—P. Abadie. (*C. R. Acad. Sci., Paris*, 9th Feb. 1948, Vol. 226, No. 6, pp. 474–475.) A constant e.m.f. is applied to the short-circuited end of a transmission line of variable length and a detector circuit is coupled loosely to the same end. The impedance to be measured is connected to the other end of the line and its value is determined from the resonance curve by means of simple formulae.

621.317.35 **2002**

L.F. Cinematic Analyser.—R. Aschen & R. Gosmand. (*Toute la Radio*, Feb. 1948, Vol. 15, No. 123, pp. 80–84.) Principles of operation, general description and complete circuit details of an instrument with c.r. tube display and covering the frequency range 20–19 000 c/s.

621.317.35 **2003**

Explanation of the Principle of the L.F. Analyser.—E. A. (*Toute la Radio*, Feb. 1948, Vol. 15, No. 123, pp. 76–77.)

621.317.361 + 621.317.763 **2004**

Frequency Measurement for Metre and Decimetre Waves.—G. Ioppolo. (*Alta Frequenza*, Dec. 1944, Vol. 13, No. 4, pp. 217–233. In Italian, with English, French and German summaries.) Discusses methods using tuned circuits and transmission lines, and their frequency limits and accuracy. The method in which the unknown frequency beats with one of the harmonics of a stable oscillator is considered and a wavemeter of this type is described for the frequency range 30–800 Mc/s.

621.317.372.029.64 **2005**

A *Q*-Factor Comparator for Echo Boxes in the 10-cm Band.—L. W. Shawe & C. M. Burrell. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 9, pp. 1443–1446: summary, *ibid.*, Part IIIA, 1946, Vol. 93, No. 1, pp. 231–232.) The method involves measurement of the time taken for the amplitude of the free oscillations generated by a p.m. signal to fall from one fixed level at the trailing edge of the pulse to another fixed level.

621.317.4 **2006**

Alternating-Current Measurements of Magnetic Properties.—H. W. Lamson. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1948, Vol. 36, No. 2, pp. 266–277.) Full paper; summary abstracted in 2173 of 1947.

621.317.72 **2007**

The Measurement of Voltage at Centimetre Wavelengths.—J. Collard. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 9, pp. 1393–1398.) The equipment includes a gold-leaf electroscope for establishing a standard of voltage; test connectors for the circuit to be measured; broad-band crystal holders for measuring the voltage, and amplifying equipment used with the crystal holders for measuring small voltages. Two sets of equipment are described, one for the range 8.5–11.0 cm and the other for the range 3.0–3.5 cm.

621.317.725 **2008**

Thermionic Valve Voltmeters for Direct Voltages.—E. Tommasini. (*Alta Frequenza*, June 1944, Vol. 13, No. 2, pp. 95–119. In Italian, with English, French and German summaries.) Discussion shows that, for greatest stability, a triode must be operated at constant anode rest-current. Negative feedback can be used to increase stability and input differential resistance, and to decrease output voltage distortion. Constant anode rest-current and negative feedback can both be obtained with a bridge circuit. Theory of such circuits is given, with a practical example.

621.317.729 : 537.291 : 621.385 **2009**

Automatic Tracer for Electron Trajectories.—J. Marvaud. (*C. R. Acad. Sci., Paris*, 9th Feb. 1948, Vol. 226, No. 6, pp. 476–478.) A semi-automatic method using an electrolyte bath, a single probe and two calibrated potentiometers.

621.317.733 **2010**

On the Sensitivity of Bridges for Impedance Measurement.—G. Montalenti. (*Alta Frequenza*, Dec. 1944, Vol. 13, No. 4, pp. 234–247. In Italian, with English, French and German summaries.) For bridges with constant supply voltage and infinite detector impedance the sensitivity is given by the product of two factors, one depending on the type of bridge and the other on the nature and value of the impedance which is varied to obtain a balance. Expressions are derived for (*a*) the maximum sensitivity near balance when the bridge contains no reactive elements, and (*b*) the total sensitivity of a bridge with a galvanometer as detector.

621.317.733 : 621.317.755 **2011**

On the Use of a Cathode Ray Oscillograph for indicating the Balance of a Bridge.—V. S. Troitski. (*Radiotekhnika, Moscow*, Jan./Feb. 1948, Vol. 3, No. 1, pp. 66–73. In Russian.)

621.317.733 : 621.317.784 **2012**

A Method of determining and monitoring Power and Impedance at High Frequencies.—J. F. Morrison & E. L. Younker. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1948, Vol. 36, No. 2, pp. 212–216.) The r.f. wattmeter described consists of a bridge circuit which is first balanced and then changed slightly to yield a meter reading of transmitted power. The meter dial, calibrated on a circuit with a matched load, is substantially correct for a wide range of unmatched loads. Details of design and construction are given, suitable for frequencies of the order of 100 Mc/s.

621.317.75 **2013**

Heterodyne Wave Analyser with Polyphase Search Voltage.—G. B. Madella. (*Alta Frequenza*, Sept. 1944, Vol. 13, No. 3, pp. 132–149. In Italian, with English, French and German summaries.) The characteristics of harmonic analysers with h.f. and l.f. filters respectively are surveyed. The l.f. method is modified by using a polyphase search voltage which enables the sign of the beat frequency to be taken into account and avoids image-frequency troubles. Similar modification of the double heterodyne system, which uses both h.f. and l.f. filters, gives more complete suppression of the image frequency and permits the choice of a very low frequency for the second filter. A single unit can thus be produced which combines the advantages of the h.f. and l.f. methods. Such an instrument is described and experimental results are given to show its capabilities. See also 1866 and 1867 above.

621.317.755 : 621.396.645.36 **2014**

A Cathode-Ray Oscillograph with Two Push-Pull Amplifiers.—E. E. Carpentier. (*Philips tech. Rev.*, 1947, Vol. 9, No. 7, pp. 202–210.) The oscillograph incorporates a push-pull amplifier for each pair of deflecting plates. At maximum sensitivity the amplification is constant within 3 db for a frequency range 10–460 000 c/s; with reduced sensitivity this range can be extended beyond 10^6 c/s. A sawtooth voltage is available for purposes extraneous to the oscillograph; its frequency can be regulated between 10 and 150 000 c/s. The new oscillograph is smaller and lighter than the older types.

621.317.76.029.64 **2015**

The Measurement of Frequencies in the Range 10 000 to 50 000 Mc/s.—G. H. Aston & L. Essen. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 9, pp. 1374–1377: summary, *ibid.*, Part IIIA, 1946, Vol. 93, No. 1, pp. 217–218.) The unknown frequency is compared with that of a harmonic of an auxiliary oscillator whose frequency is adjustable to values near 3 000 Mc/s. The oscillator frequency can be measured by the method described in 679 of 1946 (Essen & Gordon-Smith). A heterodyne signal is obtained by mixing the signal and the auxiliary oscillation in a crystal converter and passing the output to a wide-band i.f. amplifier. The method is capable of an accuracy of 1 part in 10^6 but is at present limited to 5 parts in 10^5 by the instability of the source. The apparatus has been used to investigate the properties of a resonant-cavity absorption wavemeter designed for frequencies in the region of 25 000 Mc/s. The wavemeter is described and the results obtained with it for low-power 25 000-Mc/s oscillators are briefly discussed.

621.317.761.029.4/.54 **2016**

Direct-Reading Frequency-Meters.—C. Egidi. (*Alta Frequenza*, July/Sept. 1943, Vol. 12, Nos. 7/9, pp. 324–346. In Italian, with English, French and German summaries.) Meters are classified according to their electrical, mechanical, or electromechanical principles. Descriptions are given of many types for sonic and ultrasonic frequencies.

621.317.763 + 621.392.43 **2017**

A 3-cm R.F. Spectrometer and Mismatching Impedance Unit.—E. Kettlewell, W. A. Bourne & C. Chilton. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 9, pp. 1431–1435: summary, *ibid.*, Part IIIA, 1946, Vol. 93, No. 1, p. 224.) Details are given of the design and operation of apparatus suited for use in the production of 3-cm magnetrons of the type demanding adjustment of load coupling in manufacture. The function of this equipment is to give a quick indication of the frequency pulling figure for magnetrons, in particular, Types CV191 and CV214.

The apparatus consists of a mechanically-scanned transmission-type cavity wavemeter, with associated rectifier and signal amplifier, together with a mechanically-driven mismatching impedance unit for use with standard ½-inch × 1-inch waveguide.

621.317.763 **2018**

Direct-Reading Centimetre Wavemeters.—L. W. Shawe & C. M. Burrell. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 9, pp. 1479–1486.) "An account of the design and performance of wavemeters developed for Army use in the 3-, 6-, 10- and 25-cm wavebands. Each wavemeter consisted of a resonator, together with a tuning indicator and suitable connectors. The resonators, which are described in some detail, were designed to have scales reading directly in wavelength, with accuracies which varied between ± 1 in 500 and ± 1 in 1 000."

621.317.763.029.63/.64 **2019**

The Design, Calibration and Performance of Resonance Wavemeters for Frequencies between 1 000 and 25 000 Mc/s.—L. Essen. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 9, pp. 1413–1425.) Discussion is restricted to instruments using the principal coaxial mode, the E_{010}-EH hybrid mode and the E_{010}, H_{011} and H_{11n} cylindrical waveguide modes. Non-ambiguous ranges of frequency variation of approximately 6% and 12% are obtained with the H_{011} mode and H_{111} mode respectively; with the E_{010} mode a range of the order of 10% is obtained with radial plungers, and a range of 3 : 1 with an axial plunger, the mode of vibration in this case being the E_{010}-EH hybrid. Under carefully controlled conditions the frequency of resonance of a fixed-frequency wavemeter resonating in the E_{010} mode was measured with a precision of ± 2 parts in 10^6. The accuracy of the wide-range instruments was of the order of 1 part in 10^4, while that of the intermediate category (H_{011} and H_{111} types) was about 1 part in 10^5, the limitation in the latter category being in general the temperature coefficient of the instrument. It is estimated that a careful comparison of the measured and calculated values of the frequencies of resonant wavemeters would yield a value for the speed of propagation of e.m. waves accurate to about 1 part in 10^5. The paper includes a schedule of tests which should be made on instruments intended for precision work.

621.317.78 : 621.392.029.64 **2020**

The Enthrakometer, an Instrument for the Measurement of Power in Rectangular Wave Guides.—J. Collard. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 9, pp. 1399–1402.) "The instrument consists essentially of a resistive film, forming one wall of the guide, whose change in resistance, due to the absorption of a small fraction of the power passing through the guide, is used as a measure of that power. The instrument is self calibrating, is extremely broad-banded and can be used for any wavelength for which rectangular guide is employed." For lecture summary see *ibid.*, Part IIIA, 1946, Vol. 93, No. 1, pp. 209–211.

621.317.78 : 621.396.67 **2021**

Aerial Power Meters for Radio Transmitters.—L. Palieri & A. Piccinini. (*Alta Frequenza*, Oct./Dec. 1943, Vol. 12, Nos. 10/12, pp. 379–408. In Italian, with English, French and German summaries.) A method of checking such meters is described which involves only r.f. current measurements. Experimental results for different types of meter are given. In a new type of calorimeter, the expansion of the liquid instead of its increase of temperature is measured, giving an accuracy within 1% at the highest frequencies.

621.317.78.029.63/.64 **2022**

The Measurement of Power at Centimetric and Decimetric Wavelengths.—M. C. Crowley-Milling, D. S. Gordon, C. W. Miller & G. Saxon. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 9, pp. 1452–1456.) Equipments are described for the measurement of mean powers of the order of 1–100 W for λ 3–50 cm. The factors influencing the design of water calorimeters for absolute measurements are discussed and the equipments evolved are described. 'Feed-through' wattmeters suitable for relative measurements and which distinguish between the forward-travelling and reflected powers are also described.

621.317.78.029.64 **2023**

Balanced Calorimeters for 3 000 and 10 000 Mc/s with Tapered Water Loads for H_{01} Rectangular Pipes.—L. B. Turner. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 9, pp. 1467–1476.) Discussion of the design of calorimeters in which the r.f. power is balanced against a controllable and measured l.f. power. The effects of heat losses are discussed theoretically, and means for introducing self-compensation are indicated. Practical instruments are described, with which powers of the order of 500 W at 3 000 Mc/s or 50 W at 10 000 Mc/s can be measured to within about 1%. Auxiliary apparatus for the measurement of the conductivities of sea, tap and distilled water at 3 000 Mc/s is described in an appendix, and results for these liquids are tabulated.

621.317.78.029.64 **2024**

A Wide Band Calorimeter for R.F. Power Measurements at 3 cm.—E. Kettlewell. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 9, pp. 1407–1408 : summary, *ibid.*, Part IIIA, 1946, Vol. 93, No. 1, p. 223.) A calorimeter consisting of a water load and thermocouple unit, for use where the mean power range involved is 5–200 W.

621.317.78.029.64 : 621.317.794 **2025**

Radio-Frequency Power Measurement by Bolometer Lamps at Centimetre Wavelengths.—B. Bleaney. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 9, pp. 1378–1382 : summary, *ibid.*, Part IIIA, 1946, Vol. 93, No. 1, pp. 218–219.) A description of the construction and application of bolometer lamps for the measurement of oscillator power output, and for association with transmission-line and waveguide feeders. A theoretical treatment is given of the effect of using heater wires of length comparable with λ; the theory applies only for small power inputs $< 10^{-4}$ W.

621.317.79 : 621.396.615.14 **2026**

The Design of Signal Generators for the Measurement of Receiver Noise Factor at 10- and 3-cm Wavelengths.—B. Bleaney, J. H. E. Griffiths & D. Roaf. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol 93, No. 9, pp. 1387–1392.) ". . . the monitor and attenuator are made integral parts of the signal generator; the signal emerges through a length of Pyrotenax cable of over 10 db attenuation, giving a resistive output. The signal generator is calibrated by measurement of the power output when the piston attenuator is set to low attenuation but still obeys the theoretical law. Known power outputs of the order of 10^{-14} W may thus be obtained with an accuracy of ±1 db. The screening is such that no leakage can be detected with the most sensitive receivers.

621.317.79 : 621.396.615.14 **2027**

The Design of Signal Generators for Centimetre Wavelengths.—D. C. Rogers. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 9, pp. 1457–1461 : summary, *ibid.*, Part IIIA, 1946, Vol. 93, No. 1, pp. 230–231.) The problems encountered in the design of the component parts of cm-λ signal generators are discussed from a practical standpoint. Particular attention is given to various forms of output monitor, to output piston attenuators of the H_1 and E_0 types and to screening and filtering arrangements. A description of a direct-reading power meter of the bolometer type is included in a discussion of calibration techniques. Finally, a 5-cm instrument based on these principles is described.

621.396.81.08 **2028**

Radio Technique and Apparatus for the Study of Centimetre-Wave Propagation.—H. Archer-Thompson & E. M. Hickin. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 9, pp. 1367–1373 : summary, *ibid.*, Part IIIA, 1946, Vol. 93, No. 1, pp. 215–216.) Describes the apparatus and associated techniques for the experimental investigation whose results were discussed in 517 of 1947 (Smith-Rose) and 518 of 1947 (Megaw). The point-to-point method is used; a measured power is transmitted along the path under observation and the signal received at a distant point is recorded by a receiver calibrated with a signal generator.

621.396.81.08 **2029**

A Field-Strength Meter and Standard Radiator for Centimetre Wavelengths.—J. A. Saxton & A. C. Grace. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 9, pp. 1426–1430.) The meter is suitable for operation at a wavelength of about 9 cm and takes the form of an electromagnetic-horn receiver in which the received power is measured directly by means of a bolometer. A modified form of Wheatstone bridge is used. The magnitude of field strengths covered is limited by the bolometer to the range 0.1–50 V/m. A similar e.m. horn is used as the standard radiator. The application of the instruments to the determination of the power radiated by a transmitter and to the measurement of the over-all sensitivity of a receiver is discussed.

621.317.3 **2030**

High-Frequency Measuring Techniques using Transmission Lines. [Book Review]—E. N. Phillips, W. G. Sterns & N. J. Gamara. J. F. Rider, New York, 58 pp., $1.50. (*Wireless Engr*, April 1948, Vol. 25, No. 295, p. 130.) For two- and four-terminal networks at frequencies over 100 Mc/s. A 7-ft slotted coaxial line is used to determine the voltage s.w.r. and the positions of the voltage nodes. Other characteristics are deduced by calculation.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

535.37.001.8 **2031**

Applications of Luminescent Substances.—Kröger. (*See* 1973.)

539.16.08 **2032**

Some Experiments with Geiger-Müller Counters.—J. D. Craggs, W. Bosley & A. A. Jaffe. (*J. sci. Instrum.*, March 1948, Vol. 25, No. 3, pp. 67–71.) Describes a simple counting circuit and various types of G-M counter. Representative plateau curves are given for normal cylindrical counters and for parallel-plate/wire counters. The latter have directional response if a suitable thin window is provided. A simple method for the suppression of delayed cathode emission (Paetow effect) is also outlined.

539.16.08 **2033**

Photoelectric Effect in Self-Quenching Geiger-Müller Counters.—M. V. Scherb. (*Phys. Rev.*, 1st Jan. 1948, Vol. 73, No. 1, pp. 86–87.)

539.16.08 **2034**

On the Resolving Time and Genuine Coincidence Loss for Geiger-Müller Counters.—C. E. Mandeville & M. V. Scherb. (*Phys. Rev.*, 1st Jan. 1948, Vol. 73, No. 1, pp. 90–91.) Correction, *ibid.*, 15th March 1948, Vol. 73, No. 6, p. 639.

621.365.5 **2035**

Induction Heating Applications.—N. R. Stansel. (*Gen. elect. Rev.*, Feb. 1948, Vol. 51, No. 2, pp. 44–50.) Discussion of practical applications of formulae relating flux distribution, eddy currents, temperature, and electrical efficiency.

621.365.92 **2036**

Electronic Heating of Dielectrics.—L. Thourel. (*Télévis. franç.*, March 1948, No. 35, Supplement *Électronique*, pp. 4–9.) Theory, and applications to the joining of thermoplastics, treatment of rubber, drying, sterilization and cooking.

621.384.6 **2037**

The One Million-Volt Accelerating Equipment of the Cavendish Laboratory, Cambridge.—W. E. Burcham. (*Nature, Lond.*, 6th Sept. 1947, Vol. 160, No. 4062, pp. 316–318.) A general description of the apparatus and of its performance during the past 10 years, with a short list of papers describing work carried out with it.

621.384.6 **2038**

Equipment for Automatic Synchronization of the Cyclotron.—P. Debraine & Č. Šimáně. (*C. R. Acad. Sci., Paris*, 23rd Feb. 1948, Vol. 226, No. 8, pp. 648–650.) A description of apparatus which stabilizes the magnetic field and also controls the displacement of the magnetic field by an arrangement governed by the intensity of the beam of accelerated ions. Stabilization is thus effected at the instant when exact synchronism is realized.

621.385.833 **2039**

An Experimental Electron Microscope for 400 Kilowatts.—A. C. van Dorsten, W. J. Oosterkamp & J. B. le Poole. (*Philips tech. Rev.*, 1947, Vol. 9, No. 7, pp. 193–201.) The advantages of high acceleration voltage are discussed, and each part of the instrument is described. The best possible contrast in the image is ensured by using an objective aperture with four different openings, which can be adjusted from outside. Measures are discussed for the protection of the observer against the X-radiation excited in the microscope.

621.385.833 **2040**

The Aberration of an Electrostatic Objective with [slightly] **Elliptical Central Hole.**—H. Bruck, R. Remillon & L. Romani. (*C. R. Acad. Sci., Paris*, 23rd Feb. 1948, Vol. 226, No. 8, pp. 650–652.)

621.385.833 **2041**

The Design and Construction of a New Electron Microscope.—M. E. Haine. (*J. Instn elect. Engrs*, Part I, Oct. 1947, Vol. 94, No. 82, pp. 447–459. Discussion, pp. 459–462.) Full paper. Summary abstracted in 211 of January.

PROPAGATION OF WAVES

523.78 "1940.10.01" : 551.510.535 **2042**

The Ionospheric Eclipse of October 1, 1940.—Pierce. (*See* 1924.)

523.78 "1945.07.09" : 551.510.535 **2043**

Some Experimental Results obtained by Ionospheric Investigations in Sweden during the Total Solar Eclipse of July 9, 1945.—Gejer & Åkerlind. (*See* 1925.)

621.396.11 : 518.61 **2044**

Practical Methods for the Solution of the Equations of Tropospheric Refraction.—D. R. Hartree, J. G. L. Michel & P. Nicolson. (*Physical Society Special Report on Meteorological Factors in Radio Wave Propagation*, pp. 127–168.) Calculations of propagation in a stratified medium can be carried out: (*a*) by a ray treatment, supplemented by the concept of interference when two or more rays pass through a single point and by diffraction theory in the neighbourhood of caustics of geometrical rays; or (*b*) by a wave treatment in which the field is expressed as a sum over a set of discrete modes of propagation which depend only on the refractive index structure of the atmosphere and which can be superposed in different ways to give the radiation field of a source The differential analyser has been used in the ray treatment for evaluating ray trajectories, and in the wave treatment for evaluating height-gain functions for the normal modes. See also 2892 of 1947 (Booker & Walkinshaw).

621.396.11 : 551.510.52 **2045**

A Standard Radio Atmosphere for Microwave Propagation.—A. C. Best. (*Physical Society Special Report on Meteorological Factors in Radio Wave Propagation*, pp. 267–273.) The sea-level pressure and temperature and the vertical temperature gradient of the I.C.A.N. (International Commission for Air Navigation) standard atmosphere are adopted without change. Three alternative humidity conditions are considered: (*a*) 80% relative humidity at all heights below 1.5 km; this corresponds closely to average conditions in England; (*b*) 60% relative humidity at all heights below 1.5 km; this is suggested by some U.S.A. workers; (*c*) humidity defined by a particular linear variation of vapour pressure with height, which gives a uniform ray curvature at all heights up to 1.5 km. Values of modified refractive index and ratio of ray curvature to earth curvature are tabulated for all three atmospheres to 1.5 km, the effects of pressure, temperature and humidity being shown separately.

621.396.11 : 551.510.52 **2046**

Refraction in the Lower Atmosphere and Its Applications to the Propagation of Radio Waves.—Stickland. (*See* 1940.)

621.396.11 : 551.510.52 **2047**

The Structure and Refractive Index of the Lower Atmosphere.—Sheppard. (*See* 1939.)

621.396.11 : 551.510.535 **2048**

The Investigation and Forecasting of Ionospheric Conditions.—E. V. Appleton. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 11, pp. 186–199: summary, *ibid.*, Part I, Oct. 1947, Vol. 94, No. 82, pp. 483–484.) An account of work on ionospheric exploration conducted by vertical-incidence radio sounding and a discussion of the use of data thus obtained to estimate the maximum radio frequencies at which a wave would return to the ground at any given range from a sending station. The connection between ionospheric-layer electron densities and heights and solar and seasonal phenomena is described and the anomalous behaviour of the F_2 layer is discussed with reference to longitude effect and geomagnetic control of ionization densities. Ionospheric irregularities are mentioned and methods are indicated for forecasting the ionospheric conditions affecting m.u.f. and the attenuation of radio waves by absorption.

621.396.11 : 551.510.535 **2049**

Developments in Radio Sky-Wave Propagation Research and Applications during the War.—J. H. Dellinger & N. Smith. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1948, Vol. 36, No. 2, pp. 258–266.) Discussion of: work done by the Interservice Radio Propagation Laboratory (IRPL); the circumstances leading to its establishment; the problems facing it, methods of solution, and some results; and some specific services for the military and civil authorities.

621.396.11 : 551.510.535 **2050**

The Influence of Wave-Propagation on the Planning of Short-Wave Communication.—K. W. Tremellen & J. W. Cox. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 11, pp. 200–219: summary, *ibid.*, Part I, Oct. 1947, Vol. 94, No. 28, pp. 485–486.) A review of the principal features of the various ionosphere layers, and details of the methods of calculation and presentation of ionospheric data, together with necessary corrections to m.u.f. factors. Fluctuations occurring in the various layers are discussed with reference to difficulties in predicting ionospheric data. Formulae governing the attenuation of the sky-wave and a description of noise and noise curves are given. As an example, data for two specific transmissions of different path-lengths are included. Irregularities, fade-outs, magnetic disturbances, and the prediction of magnetic storms are also discussed.

621.396.11 : 551.510.535 **2051**

On Magneto-Ionic Splitting [of radio waves] **in the Sporadic E Layer.**—V. M. Driatski. (*C. R. Acad. Sci. U.R.S.S.*, 1947, Vol. 58, No. 5, pp. 775–778. In Russian.) A brief report on several years' observations at Bay Tiksi (71°35′N, 128°55′E). The main conclusions are: (*a*) magneto-ionic splitting of radio waves is observed not only on reflection from regular F_2, F_1 and E layers but also from the sporadic E layer; (*b*) the differences in critical frequencies of the components of the waves indicate the presence of a considerable number of free electrons in the sporadic E layer; (*c*) the sporadic E layer has apparently a grid-like structure. These conclusions, however, do not diminish the importance of ions in the formation of the sporadic E layer.

621.396.11.018.41 : 551.510.535 **2052**

Effect of the Vertical Displacement of the Ionized Layers on the Frequency of Radio Waves.—D. Romell. (*C. R. Acad. Sci., Paris*, 22nd March 1948, Vol. 226, No. 12, p. 1007.) The results obtained by Decaux (1725 of June) can be explained by vertical displacement of the ionosphere reflecting layer at about 10 m/s. The diurnal variations of the height of the F_2 layer account satisfactorily for the diurnal frequency variations observed by Decaux.

621.396.11.029.58 **2053**

Short-Wave Echoes.—H. A. Hess. (*Funk u. Ton*, Feb. 1948, No. 2, pp. 57–65.) Description of experiments carried out at Frederikshavn and Randers (Denmark) during 1941–1945, using frequencies between 10 and 20 Mc/s. Measurements of the path-time difference between direct and reverse transmissions gave a mean value of 0.137 767 sec for a complete circuit of the earth.

621.396.81.08 **2054**

Radio Technique and Apparatus for the Study of Centimetre-Wave Propagation.—Archer-Thompson & Hickin. (*See* 2028.)

621.396.812 + 538.566.3 **2055**

Gyro-Interaction of Radio-Waves obtained by the Pulse Method.—M. Cutolo. (*Nature, Lond.*, 13th Dec. 1947, Vol. 160, No. 4076, p. 834.) Description of observations of the effect on 630-m and 1 250-m transmissions of a p.m. transmitter operating in the wavelength range 265–285 m. For earlier work see 513 of 1947 (Cutolo, Carlevaro & Gherghi).

621.396.812 : 551.510.52 **2056**

The Influence of Tropospheric Conditions on Ultra-Short-Wave Propagation.—E. V. Appleton. (*Physical Society Special Report on Meteorological Factors in Radio Wave Propagation*, pp. 1–17.) A general introductory survey of recent advances in the subject. The troposphere is regarded as a non-homogeneous medium, and the factors determining the atmospheric refractive index are considered. Both the refractive and reflective properties of atmospheric inhomogeneities can cause increased fields beyond the optical horizon; experimental results are given from early and recent papers on anomalous propagation. The action of ducts, the origin of superrefracting conditions, and scattering by raindrops are briefly discussed.

621.396.812 : 551.510.52 **2057**

Radio Climatology.—Durst. (*See* 1943.)

621.396.812 : 621.396.96 **2058**

The Vertical Distribution of Radar Field Strength over the Sea under Various Conditions of Atmospheric Refraction.—J. A. Ramsay. (*Physical Society Special Report on Meteorological Factors in Radio Wave Propagation*, pp. 238–242.)

621.396.812(931) : 621.396.96 **2059**

Observations of Unorthodox Radar Vision in the Vicinity of New Zealand and Norfolk Island.—Alexander. (*See* 1969.)

621.396.812.029.63/.64 **2060**

Meteorological Effects on the Propagation of Very Short Waves.—J. Voge. (*Onde élect.*, March 1948, Vol. 28, No. 252, pp. 99–107.) A general review of the atmospheric conditions which affect the propagation of decimetre and centimetre waves. Particular reference is made to horizontal stratification, variation of refractive index with height, temperature, humidity, clouds and rain, and many experimental results are discussed. See also 516 of 1947 (Booker).

621.396.812.029.64 **2061**

An Experimental Study of the Effect of Meteorological Conditions upon the Propagation of Centimetric Radio Waves.—R. L. Smith-Rose & A. C. Stickland. (*Physical Society Special Report on Meteorological Factors in Radio Wave Propagation*, pp. 18–37.) Continuous observations of field strength at frequencies above 3 000 Mc/s were made for a period of two years over a land path of 61 km and a sea path of 92 km. Four separate links, with different terminal heights, were used over the sea path; three of these extended beyond optical range.

The effects of fog and frontal passages on signal strengths are described for the land and sea paths. Except for slight fading in anticyclonic conditions, transmission over the optical sea path showed comparatively little variation. From aircraft observations of temperature and humidity made over the path of propagation, the refractive index gradient was calculated for the first few hundred metres of atmosphere. The field strength deduced from this gradient agrees closely with that observed. See also 2892 of 1947 (Booker & Walkinshaw).

621.396.812.029.64 : 621.396.96 **2062**

The Attenuation and Radar Echoes produced at Centimetre Wave-Lengths by Various Meteorological Phenomena.—J. W. Ryde. (*Physical Society Special Report on Meteorological Factors in Radio Wave Propagation*, pp. 169–188. Discussion, pp. 188–189.) "The attenuation and the intensity of radar echoes produced by fog, cloud, rain, hail and snow are computed on the basis of electromagnetic theory for wave-lengths in the cm band; due account is taken of the particle size distributions. In general, the particles are not small enough for the simple Rayleigh law to hold. Tables and curves are given which enable the attenuation and echo intensity to be readily calculated for any given case. In general, both effects increase rapidly as the wave-length diminishes and their magnitudes may be considerable with rain, hail or snow. For completeness, a brief summary of Van Vleck's results on the attenuation produced by the atmospheric gases is included." See also 515 of 1947.

621.396.812.4.029.63/.64 **2063**

Results of Microwave Propagation Tests on a 40-Mile Overland Path.—A. L. Durkee. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1948, Vol. 36, No. 2, pp. 197–205.) Wavelengths in the range 1.25–42 cm were used. The tests at each wavelength extended over periods of 2–20 months. Various types of fading are analysed statistically to show diurnal and seasonal variations, and the correlation with meteorological phenomena is discussed.

RECEPTION

621.396.619.13 **2064**

Distortion of F.M. Signals in Passage through Electrical Networks.—F. L. H. M. Stumpers. (*Tijdschr. ned. Radiogenoot.*, Jan. 1948, Vol. 13, No. 1, pp. 1–21. In Dutch, with English summary.) Full account of part of the work described in 2221 of 1947.

621.396.621 **2065**

Fremodyne F.M. Receivers.—A. A. McK. (*Electronics*, Jan. 1948, Vol. 21, No. 1, pp. 83–87.) Circuit details of this low-cost mass-produced receiver are discussed. Tests of sensitivity, quieting-sensitivity, distortion, relative audio response, selectivity and radiated interference were conducted for two fremodyne receivers, one fremodyne adaptor, and two conventional types of f.m. receiver. Interfering signals on neighbouring channels which 'captured' the conventional receivers merely produced increased interference with the fremodyne receivers. Radiation interference had a maximum value of 20–30 mV on one channel for each fremodyne receiver. Audio output distortion is of the order of 6–8% for a 1-mV signal.

621.396.621 **2066**

Trends in Mass Production of Radio Receivers.—M. Chauvierre. (*Radio franç.*, Feb. 1948, pp. 9–17.) Discusses printed circuits, Sargrove's E.C.M.E. (1913 of 1947), and the UA-55 all-stage valve (1203 of April). Circuits and characteristics are given for the UA-55 as grid detector, as fixed-μ or variable-μ valve, and as frequency changer, together with the circuit of a superheterodyne receiver using only UA-55 valves.

621.396.621 : 621.396.96 **2067**

Radar Receivers.—W. B. Lewis. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, pp. 272–279.) Survey of: requirements for radar receivers and the bearing of these requirements on research; noise factor and its relation to internal noise, input noise and source temperature; design of r.f. and i.f. amplifiers, and of mixers for cm λ; methods of a.f.c. and a.g.c.; common-aerial working; special types such as superregenerative and search receivers.

621.396.621.2 **2068**

Input Circuits for Broadcasting Radio Receivers.—L. de Valroger. (*Rev. tech. Comp. franç. Thomson-Houston*, May 1947, No. 7, pp. 5–37. In French, with English summary.) A study of the characteristics of receiving aerials and a comprehensive treatment of receiver input circuits, from which are deduced the circuits giving optimum results for medium and long waves. The effects of the various circuit elements on receiver performance are analysed and suitable numerical values are assigned for each element. Practical rules are given, based on theory and confirmed experimentally. To be continued.

621.396.662 : 621.396.[397].62 **2069**

Inductive Tuning System for F.M.-Television Receivers.—P. Ware. (*Proc. Radio Cl. Amer.*, May 1946, Vol. 23, No. 5, pp. 9–16.) Illustrated description of a 3-section tuning unit with which tuning ratios as high as 7 can be obtained for frequencies up to 1 000 Mc/s. The associated motor-driven push-button tuning mechanism is described. For basic principles see 2293 of 1938.

621.396.81 : 621.317.755 **2070**

On the Evaluation of the Signal/Noise Ratio in Oscillographic Receivers.—U. Tiberio. (*Alta Frequenza*, July/Sept. 1943, Vol. 12, Nos. 7/9, pp. 316–323. In Italian, with English, French and German summaries.) Theory based on the Boltzmann statistic. A formula is derived for the probability of confusion between the true signal image and an occasional irregularity in the oscillogram.

621.396.813 **2071**

On the Summation of Nonlinear Distortions.—M. A. Sapozhkov. (*Zh. tekh. Fiz.*, Oct. 1947, Vol. 17, No. 10, pp. 1187–1194. In Russian.)

621.396.822 **2072**

Thermal Noise in Resistors.—S. Rodda. (*Wireless Engr*, April 1948, Vol. 25, No. 295, p. 131.) The consequences of suddenly placing a unit charge in a small cavity in the material of a resistor are considered. Such effects may be produced by electrons and afford a better explanation of noise voltage than that of Bell (1038 of 1946).

621.396.822 : 621.385.2 **2073**

The Transmission-Line Diode as Noise Source at Centimetre Wavelengths.—P. Kompfner, J. Hatton, E. E. Schneider & L. A. G. Dresel. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 9, pp. 1436–1442: summary, *ibid.*, Part IIIA, 1946, Vol. 93, No. 1, pp. 225–226.) "After a short survey of existing methods of absolute calibration of receivers in the centimetre waveband, the transmission-line noise diode is described and its operation explained. The available noise power is calculated on the assumption of arbitrary terminations of the 'active' line, i.e. of the part of the line across which emission current is flowing. Two special cases are considered in detail, the case when the active line is 'matched' at both ends, particularly suitable for absolute calibrations of receivers, and the case when the line is 'resonant', giving increased noise output, and particularly suitable as a relative source of noise or as a transfer standard.

"Results of experiments on the absolute noise output, on the electronic attenuation, on the influence of transit-time and on space-charge smoothing are given, the last showing that some mechanism of noise-reduction exists even at frequencies as high as 3 000 Mc/s. Details are given of applications of the resonant diode in practice."

621.396.621 **2074**

Ultra- and Extreme-Short Wave Reception. [Book Review]—M. J. O. Strutt. D. Van Nostrand, New York: Macmillan, London, 387 pp., 37s. 6d. (*Wireless Engr*, April 1948, Vol. 25, No. 295, pp. 128–129.) "Dr. Strutt has performed a useful service to the practical designer . . . by providing a balanced review, which also incorporates much of his own practical experience in this field . . . The theoretical background is provided by verbal explanations rather than formal proofs. Advanced mathematical ability is not required of the reader." Over 400 references are listed.

621.396.621.001.4 **2075**

Philips Manual of Radio Practice for Servicemen. [Book Review]—E. G. Beard. Philips Electrical Industries of Australia, Sydney, 495 pp., 22s. 6d. (Australian). (*Wireless Engr*, April 1948, Vol. 25, No. 295, p. 129.) "The treatment is descriptive and non-mathematical, and of an elementary nature. It covers most of the circuits commonly used in broadcast receivers and they are described well, but briefly."

STATIONS AND COMMUNICATION SYSTEMS

621.391.63 : 534.321.9 **2076**

Ultrasonic Cell of Large Area for the Modulation of Light.—Giacomini. (*See* 1847.)

621.394/.396 **2077**

Long-Distance Point-to-Point Communication.—A. H. Mumford. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 11, pp. 23–43. Discussion, *ibid.*, Part IIIA, 1947, Vol. 94, No. 12, pp. 397–400. Summary, *ibid.*, Part I, Oct. 1947, Vol. 94, No. 82, pp. 465–466.) Advances in technique during the war years and expansion of the network maintained by the Post Office are discussed. The relative advantages of commercial single-sideband as compared with double-sideband operation have been found to outweigh its disadvantages of increased complexity of equipment and the high degree of frequency stability required. Rhombic and multi-element arrays and their conflicting advantages are analysed. Forecasting of ionospheric data forms an important part in the planning and operation of a long-distance network. An increasing use of multichannel voice-frequency telegraph equipment working into single-sideband transmitting and receiving equipment may be expected. Only by compression of the bandwidth for speech below that normally considered the minimum for satisfactory reproduction can the frequency spectrum available for long-distance telephony be made nearly adequate.

621.395.43 : 621.392.029.64 **2078**

Multiplex Links using Waveguides.—A. V. J. Martin. (*Toute la Radio*, Feb. 1948, Vol. 15, No. 123, pp. 72–75.) A résumé of the main points of a paper by H. Barlow (257 of January).

621.396.619.16 **2079**

Pulse Communications : Parts 1-3.—D. Cooke ; Z. Jelonek & E. Fitch ; A. J. Oxford. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 11, pp. 83–105 : summary, *ibid.*, Part I, Oct. 1947, Vol. 94, No. 82, pp. 471–472.) Part 1 is a general review of amplitude, length, phase and frequency p.m., including a comparison between time-allocation and frequency-allocation multiplex and considerations of pulse shape, repetition frequency, signal/noise ratio and privacy. P.m. is compared with c.w. modulation for a v.h.f. radio link and its use on cables and in omnidirectional broadcasting is examined. A keyed pulse train can reduce fading effects in long-distance h.f. communication.

In part 2 the results of theoretical and experimental analyses of technical problems are presented graphically. The spectrum of modulated pulses is used to estimate the intelligibility of received speech with reference to minimum repetition frequency. The pulse systems are compared amongst themselves and with conventional a.m. and f.m. systems. Examination of a spongy locking system is followed by the determination of the optimum length and shape of the transmitted pulse.

Part 3 discusses the relative merits of various circuit techniques used for synchronization, demodulation and the production of multiplex systems, and future trends.

621.396.65 **2080**

Résumé of V.H.F. Point-to-Point Communication.—F. Hollinghurst & C. W. Sowton. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 11, pp. 115–130 : summary, *ibid.*, Part I, Oct. 1947, Vol. 94, No. 82, pp. 475–476.) An outline of British developments during and before the war, with brief reference to similar developments abroad. Engineering aspects of the planning, provision and operation of v.h.f. radio links are discussed, with particular reference to British Post Office practice. A typical multichannel R/T link and some special war-time applications of v.h.f. transportable R/T equipment are described. Possible future developments are discussed.

621.396.65 **2081**

Ultra-High-Frequency Techniques applied to Mobile and Fixed Communication Services.—J. Thomson, J. D. Denly, I. J. Richmond, F. Pugliese & H. Borg. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 11, pp. 107–114 : summary, *ibid.*, Part I, Oct. 1947, Vol. 94, No. 82, pp. 470–471.) A statement of the advantages of u.h.f. for short-range communication within the optical range, with a review of : (*a*) the available valves, (*b*) the various forms of crystal and resonator control of v.m. oscillators, (*c*) a.m., f.m. and p.m. of u.h.f. signals, and (*d*) amplifiers, detectors and aerials.

621.396.7 + 621.397.2 **2082**

Engineering Arrangements for Broadcasting the Royal Wedding.—L. Hotine. (*B.B.C. Quart.*, April 1948, Vol. 3, No. 1, pp. 52–58.) A detailed description of the technical equipment used to provide the necessary facilities for television and for broadcasting both in Great Britain and throughout the world.

621.396.931 **2083**

Military Radio Communications.—J. B. Hickman. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 11, pp. 60–73 : summary, *ibid.*, Part I, Oct. 1947, Vol. 94, No. 82, pp. 469–470.) The importance of radio communication in the modern army is stressed. The principal field radio equipments and war-time developments are described. V.h.f. military equipment is now preferred to h.f. ; possible future developments are considered.

621.396.932 **2084**

Low-, Medium- and High-Frequency Communication to and from H.M. Ships.—W. P. Anderson & E. J. Grainger. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 11, pp. 46–58. Discussion, *ibid.*, Part IIIA, 1947, Vol. 94, No. 12, pp. 437–440. Summary, *ibid.*, Part I, Oct. 1947, Vol. 94, No. 82, pp. 467–468.) An outline is given of naval communication requirements and the development of equipment and control systems from 1934 to 1939, together with tabulated details of transmitters, receivers and wavemeters in use at the outbreak of war. The extension of equipment to meet war-time needs is described and the problems of providing suitable aerial arrangements are discussed with reference to the restricted space available and the necessity for providing aerial trunks for most transmitter aerials. A diagram illustrates aerial arrangements on a modern battleship. New equipment mentioned based on war-time experience includes the ' 600 Series ' transmitters, designed to cover 200–500 kc/s and 1 500–24 000 kc/s with different power outputs up to 2 kW, and two receivers designed to work over a combined range of 14.7–30 000 kc/s.

621.396.933 **2085**

Aeronautical Communications.—B. G. Gates. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 11, pp. 74–81 : summary, *ibid.*, Part I, Oct. 1947, Vol. 94, No. 82, pp. 473–474.) Operational requirements are outlined and the special conditions to which airborne apparatus is exposed are discussed. The effect of these requirements and conditions on broad design principles is considered, and typical examples are quoted of equipments which meet the requirements. Probable future developments are forecast.

621.396.97 **2086**

The War-Time Activities of the Engineering Division of the B.B.C.—H. Bishop. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 11, pp. 169–185 : summary, *ibid.*, Part I, Oct. 1947, Vol. 94, No. 82, pp. 481–482.) Regrouping and extensive expansion of B.B.C. services during the war years involved an increase of 97 transmitters as compared with the 1939 total of 24, and an increased radiated power of 5 040 kW. The grouping of several high-power transmitters on one wavelength made enemy direction finding impossible except within 25 miles of any station ; Fighter Command ordered a close-down when necessary. High-accuracy crystal-drive equipment achieved the required close synchronization between transmitters without the use of line links. High-powered transmissions were achieved by operating transmitters in parallel, with horizontal polarization to prevent enemy direction finding. Development of apparatus and techniques in emergency studio centres greatly assisted the continuity and quality of post-war broadcasting. Intricate land-line and radio networks between studios and transmitters ensured that the most violent enemy action did not interrupt programmes. Monitoring of world broadcasting enabled a constant check to be kept on the position of enemy transmitters; anti-jamming measures were taken when required. Broadcasting to enemy and enemy-occupied countries was useful for guiding aircraft, for countermeasure work against raiding aircraft, and for broadcasting code-messages to paratroops.

621.396.619.13 **2087**

Frequency Modulation. [Book Review]—P. Güttinger. Gebr. Leemann, Zürich, 183 pp. (*Wireless Engr*, April 1948, Vol. 25, No. 295, p. 129.) For radio engineers and students of h.f. technology. The treatment is necessarily mathematical. Principles of f.m. and ph.m. and their application to transmitters and receivers are considered. Each of the 36 sections is complete in itself; the complete bibliography contains 295 references.

SUBSIDIARY APPARATUS

621-526 **2088**

A Variable-Radio-Frequency-Follower System.—R. F. Wild. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1948, Vol. 36, No. 2, pp. 281–285.) In the servo-system described, the mechanical changes of the leader and follower vary the tuning of an oscillator and a discriminator, balance always being achieved when the two circuits are tuned to the same frequency. Several methods of applying this technique are discussed, with details of design and performance of typical circuits.

TELEVISION AND PHOTOTELEGRAPHY

621.397.335 **2089**

Synchronization in Television.—H. Delaby. (*Télévis. franç.*, March 1948, No. 35, pp. 23–27.) Basic principles and a short account of methods used in America, England, France and Germany.

621.397.5 : 535.88 **2090**

Projection Television.—I. G. Maloff. (*Proc. Radio Cl. Amer.*, May 1946, Vol. 23, No. 5, pp. 5–8.) Long summary. The use of moulded aspherical correcting lenses is considered.

621.397.5 : 621.396.67 **2091**

Television Installation.—W. W. Waye. (*Radio News*, Dec. 1947, Vol. 38, No. 6, pp. 52–54 . . 128.) The location of aerials for good television reception in urban districts is discussed. The reasons for weak pictures and ghost images are explained and methods of eliminating these faults by directive aerials and correct orientation are given. Installation procedure for any type of television aerial is tabulated.

621.397.6 : 621.385.832 **2092**

Modern Electromagnetic Sweep Technique.—A. de Saint-Romain. (*Radio franç.*, Feb. 1948, pp. 35–43.) A detailed discussion based on the work of Schade (574 of February) and Schlesinger (573 of February).

621.397.6 : 621.396.67 **2093**

A New Wide Band U.S.W. Aerial for Television.—B. V. Braude. (*Radiotekhnika, Moscow*, Sept./Oct. 1947, No. 7, pp. 8–21. In Russian.) It is suggested that the construction of a turnstile aerial can be simplified if flat ribbon conductors are used instead of those with a circular cross-section. Accordingly an aerial has been developed in which the elements are made in the shape of two grids lying in the same plane and short-circuited at the end opposite to the input terminals (Figs. 12 and 13). A detailed report is presented of experiments with these aerials and approximate theory of operation is given. Experiments were also conducted with multi-stack aerials. Finally, these aerials are compared with American types of turnstile aerial.

621.397.7 **2094**

Alexandra Palace Television Centre.—H. Sassoon. (*Télévis. franç.*, Feb. 1948, No. 34, pp. 10–13.) A short account of B.B.C. studio facilities and transmitter and aerial equipment.

TRANSMISSION

621.396.61 : 621.396.96 **2095**

Radar Transmitters: A Survey of Developments.—O. L. Ratsey. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, pp. 245–261. Discussion, *ibid.*, Part IIIA, 1946, Vol. 93, No. 7, p. 1302.) "Beginning with the first 12-metre transmitters adapted from ionospheric research equipment, the history of the extension towards shorter and shorter wavelengths is traced over the decade 1935–45, concluding with an indication of the elements of a 3-cm r.f. unit. The major Service equipments are described with special reference to the technical advances they exhibited, particularly on the modulation side. The circuit fundamentals of the duplexing devices (t.r. switches), which may normally be regarded as part of the transmitter, are also given."

621.396.61.029.54 **2096**

50-Watt Broadcast Transmitter, Type T.H.1163.—C. Beurtheret. (*Rev. tech. Comp. franç. Thomson-Houston*, May 1947, No. 7, pp. 47–51. In French, with English summary.) A high-quality transmitter for the medium waveband (550–1 500 kc/s).

621.396.611.33 : 621.396.671 **2097**

The Matching Ranges of Transmitters.—P. Mourmant. (*Radio franç.*, Feb. 1948, p. 8.) Corrections to 595 of February.

621.396.82 **2098**

Unwanted Radiations from Medium-Wave Broadcast Transmitters.—J. B. Webb. (*B.B.C. Quart.*, April 1948, Vol. 3, No. 1, pp. 59–64.) A discussion of the production of harmonic radiation on multiples of the fundamental carrier frequency, and of combination frequencies due to the interaction of two or more transmitters. Methods of identifying and suppressing such unwanted radiations are also considered.

VALVES AND THERMIONICS

621.3.032.216 : 621.315.61 **2099**

Energy Levels in Oxide Cathode Coatings.—Wright. (*See* 1981.)

621.383 **2100**

Photoelectron Multipliers with an Sb-Cs Cathode.—S. M. Feinstein. (*Zh. tekh. Fiz.*, Jan. 1948, Vol. 18, No. 1, pp. 39–48. In Russian.)

621.385 **2101**

The Development of Radio Valves.—J. H. E. Griffiths. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 1, pp. 173–179.) A brief survey for m- and cm-λ transmitting and receiving valves, mixers, gas-filled switches and modulators. Because of its low power output and efficiency, the klystron was superseded by the magnetron, whose stability and efficiency were increased by 'strapping' alternate segments. The scaling-down of magnetrons for 3-cm operation, magnetron-to-waveguide couplings, and cathode design are also discussed.

621.385 : 621.317.729 : 537.291 **2102**

Automatic Tracer for Electron Trajectories.—J. Marvaud. (*C. R. Acad. Sci., Paris*, 9th Feb. 1948, Vol. 226, No. 6, pp. 476–478.) A semi-automatic method using an electrolyte bath, a single probe and two calibrated potentiometers.

621.385.029.63/.64 **2103**

Small-Signal Analysis of Traveling-Wave Tube.—C. Shulman & M. S. Heagy. (*RCA Rev.*, Dec. 1947, Vol. 8, No. 4, pp. 585–611.) Optimum design curves are obtained for an idealized valve consisting of a cylindrical shell electron beam moving parallel to the axis of a free-space perfectly conducting helix wound with small-diameter wires. The beam may be inside or outside the helix. The method is based on Hahn's theory (3521 of 1939). For maximum gain the helix should be small and close to the beam, and an optimum pitch and beam voltage exist for a given λ and helix diameter. For minimum noise factor the beam should not be close to the helix, and no optimum pitch and beam voltage for a given λ and helix diameter exist; both should be as small as possible.

621.385.032.216 : 537.533 **2104**

A Method of Studying the Thermionic Emission of Oxide-Coated Cathodes in Gaseous Conduction Devices.—W. F. Hodge. (*Phys. Rev.*, 1st Jan. 1948, Vol. 73, No. 1, p. 95.) Summary of Amer. Phys. Soc. paper.

621.385.1.012 **2105**

Determination of Static Valve Characteristics by Extrapolation.—G. Gregoretti. (*Alta Frequenza*, Dec. 1944, Vol. 13, No. 4, pp. 195–216. In Italian, with English, French and German summaries.) A method for obtaining the characteristics for normal cathode heating voltage from measurements at reduced voltage.

621.385.1.016.4.029.63 : 537.56 **2106**

Production of High-Frequency Energy by Ionized Gases.—Steinberg. (*See* 1908.)

621.385.2 : 621.396.822 **2107**

The Transmission-Line Diode as Noise Source at Centimetre Wavelengths.—Kompfner, Hatton, Schneider & Dresel. (*See* 2073.)

621.385.38 **2108**

Grid-Controlled Hot-Cathode Gas-Discharge Valves.—H. Hertwig. (*Funk u. Ton*, April 1948, No. 4, pp. 175–182.) Explanation of the operation of thyratrons and short account of their practical applications.

621.385.4 **2109**

Potential Distributions in Screen-to-Anode Space of Beam Tetrodes.—S. Rodda. (*Wireless Engr*, Jan. 1948, Vol. 25, No. 292, p. 33.) According to Gill (*Phil. Mag.*, May 1925, pp. 993–1005), over a range of current densities there are apparently two steady-state solutions for this potential distribution. Discussion of the transient conditions shows that one of Gill's two voltage distributions is impossible as a final steady state.

621.396.615.142.2 **2110**

Electronic Tuning of Reflection Klystrons.—B. Bleaney. (*Wireless Engr*, Jan. 1948, Vol. 25, No. 292, pp. 6–11.) "A simple theory of the electronic frequency control of a reflection klystron is developed by which it is possible to calculate the frequency deviation $\pm (\Delta f)_m$ over which the power output does not fall below a certain fraction m of the power output at zero frequency deviation. It is shown that for a simple resonator of high impedance $(\Delta f)_m = \pm A\beta^2 I_0{}^2/CW_1$ where β = modulation factor of resonator gap, I_0 = beam current, C = resonator capacitance, W_1 = power drawn from the beam, and A is a Bessel function expression whose maximum value is derived as a function of m. In particular the frequency range from half-power to half-power has a maximum value of $(\Delta f)_{\frac{1}{2}} = \pm 52\,\beta^2 I_0{}^2/CW_1$ Mc/s (I_0 in mA, C in $\mu\mu$F, and W_1 in mW) which occurs when the tube is loaded to deliver its maximum output. When the tube is used with a lightly-coupled load such as a crystal mixer the resonator may require to be loaded with some extra loss to obtain the maximum value of $(\Delta f)_{\frac{1}{2}}$."

MISCELLANEOUS

002 : 778.1 **2111**

Science Museum Photostat Service.—The service is available to purchasers of special requisition forms which can be obtained singly for 3s. or in pads of 50 for £5. They may be obtained from the Director, Science Museum, South Kensington, London, S.W.7; applications should be accompanied by a remittance payable to Science Museum, London, S.W.7, and crossed 'A/c H.M. Paymaster-General'. The 'value' of one requisition form is from six to ten photostat sheets, according to the nature of the publication. A declaration must be signed with each requisition to comply with the Copyright Act.

016 : 621.396 **2112**

Bibliography of [1947 I.E.E.] **Radiocommunication Convention Papers.**—(*J. Instn elect. Engrs*, Part I, Oct. 1947, Vol. 94, No. 82, pp. 494–496.) A list of supporting papers. Summaries of all but a few of these papers are given, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, pp. 44–45, 59, 82, 105–106, 114, 131, 166–168, 220, 243 & 267–268. For abstracts of survey papers read at the Convention, see other sections; all survey papers appear in full, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, and summarized, *ibid.*, Part I, Oct. 1947, Vol. 94, No. 82.

061.3 URSI-IRE **2113**

URSI-I.R.E. Meeting.—(*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1948, Vol. 36, No. 1, pp. 103–104.) Titles and authors of 50 papers read at the meeting in Washington, Oct. 1947.

621.39 "1939/1945" **2114**

Telecommunications in War.—A. S. Angwin. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 11, pp. 7–15: summary, *ibid.*, Part I, Oct. 1944, Vol. 94, No. 82, pp. 463–464.) Other summaries noted in 2644 and 4094 of 1947.

621.396 **2115**

Summarizing Review [of trends in radio communication].—C. C. Paterson. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 11, pp. 16–22; summary, *ibid.*, Part I, Oct. 1947, Vol. 94, No. 82, p. 464.) Other summaries noted in 2649 and 4096 of 1947.

621.396.1.029.64 **2116**

Physics and Technics of Microwaves.—H. H. Klinger. (*Funk u. Ton*, April 1948, No. 4, pp. 183–192.) A review of the principal properties of microwaves and discussion of waveguides, cavity resonators, magnetrons, and propagation phenomena, including anomalous dispersion and absorption.

621.396.029.6 **2117**

Very High-Frequency Techniques. [Book Review]—Staff of the Radio Research Laboratory, Harvard. McGraw-Hill Publishing Co., London, 1057 pp., 84s. (*Wireless Engr*, March 1948, Vol. 25, No. 294, pp. 87–88.) "Represents a summary of the methods, theories and circuits used by the Radio Research Laboratory that it is believed will be of general interest to radio engineers and physicists . . . Should be invaluable to all concerned with frequencies of over 100 Mc/s. There is also a good deal in it of application to somewhat lower frequencies."

ABSTRACTS and REFERENCES

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to it.

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ACOUSTICS AND AUDIO FREQUENCIES

016 : 534 **2118**

References to Contemporary Papers on Acoustics.—A. Taber Jones. (*J. acoust. Soc. Amer.*, March 1948, Vol. 20, No. 2, pp. 201–213.) Titles of 334 papers, including 134 published in Germany, mostly in the years 1939–1943. For earlier parts, see 1531 of June and back references.

534.138 **2119**

Theoretical and Observed Absorption of Sound in Suspensions.—R. J. Urick. (*J. acoust. Soc. Amer.*, March 1948, Vol. 20, No. 2, p. 225.) Summary only.

534.2 **2120**

Absorption and Scattering for Impedance Boundary Conditions on Spheres and Circular Cylinders.—M. Lax & H. Feshbach. (*J. acoust. Soc. Amer.*, March 1948, Vol. 20, No. 2, pp. 108–124.)

534.2 **2121**

Compressional Wave Front Propagation through a Simple Vortex.—R. B. Lindsay. (*J. acoust. Soc. Amer.*, March 1948, Vol. 20, No. 2, pp. 89–94.)

534.21 **2122**

The Propagation of an Acoustic Wave along a Boundary.—I. Rudnick. (*J. acoust. Soc. Amer.*, March 1948, Vol. 20, No. 2, p. 149.) Correction to 3387 of 1947.

534.213 : 534.241 **2123**

Examples of Propagation of Underwater Sound by Bottom Reflection.—R. W. Young. (*J. acoust. Soc. Amer.*, March 1948, Vol. 20, No. 2, p. 224.) Summary only.

534.213 : 534.321.9 **2124**

The Attenuation of Ultrasonic Sound Waves in Water.—R. W. Leonard. (*J. acoust. Soc. Amer.*, March 1948, Vol. 20, No. 2, p. 224.) Summary only. Measurements of attenuation in distilled water in the range 50–450 kc/s are in good agreement with those of Fox & Rock (2456 of 1941) in the range above 10 Mc/s. Measurements on filtered sea water from 50 to 180 kc/s give values for the attenuation about 10 times those for distilled water.

534.213 : 534.321.9 **2125**

Absorption of Sound in Fresh Water and in the Sea.—L. N. Liebermann. (*J. acoust. Soc. Amer.*, March 1948, Vol. 20, No. 2, pp. 223–224.) Summary only. At 500 kc/s and 1 000 kc/s the absorption coefficient in fresh water is proportional to (frequency)^2. Measurements in the sea at 120 kc/s gave a value more than 5 times the fresh-water upper limit. Measurements at 500 kc/s and 1 000 kc/s indicate that in sea water the absorption is not proportional to (frequency)^2. At 1 000 kc/s the absorption is only slightly higher than in fresh water.

534.32 : 786.6 **2126**

Some Measurements of the End-Corrections and Acoustic Spectra of Cylindrical Open Organ Pipes.—F. Ingerslev & W. Frobenius. (*Trans. Dan. Acad. tech. Sci.*, 1947, No. 1, pp. 7–44.) A formula is derived for the physical length of an open pipe. This can be used for both cylindrical and conical pipes ; the accuracy is reduced in the latter case. Results are given showing the effect of (*a*) scale ratio, (*b*) height and width of the mouth, (*c*) air consumption, and (*d*) nicks in the tongue, on the harmonic content of the emitted sound.

534.321.9 : 526.956.5 **2127**

Progress of Echo Sounding.—(*Electrician*, 30th Jan. 1948, Vol. 140, No. 3633, pp. 339–340.) Modern echo-sounding gear uses magnetostriction oscillators operating on frequencies between 10 and 40 kc/s. For very great depths quartz oscillators are used. Similar apparatus is used for transmission and reception and continuous automatic records of depth are obtained to an accuracy within about 1%. Some details are given of various types of equipment developed by the Admiralty.

534.321.9 : 534.22 **2128**

A Study of Ultrasonic Velocity and Absorption in Liquid Mixtures.—C. J. Burton. (*J. acoust. Soc. Amer.*, March 1948, Vol. 20, No. 2, pp. 186–199.) Measurements at 5–25 Mc/s in mixtures of water with alcohols, glycols, and glycol ethers.

534.422 : 534.321.9 **2129**

High Frequency Whistles ; Edge Tones and Resonance.—W. L. Nyborg & H. K. Schilling. (*J. acoust. Soc. Amer.*, March 1948, Vol. 20, No. 2, p. 224.) Summary only.

534.44 **2130**

The Analysis of Acoustic Signals by means of the Self-Consistent Spectrum.—J. J. Markham. (*J. acoust. Soc. Amer.*, March 1948, Vol. 20, No. 2, pp. 95–98.)

534.61 **2131**

Measurement of Directivity Factor.—C. J. Burbank. (*J. acoust. Soc. Amer.*, March 1948, Vol. 20, No. 2, p. 223.) Summary only. A mechanical mounting permits rotation of the equipment about two mutually perpendicular axes. Electronic apparatus integrates the power.

534.64 **2132**

A Method for Measuring Acoustic Source Impedance.—J. E. White. (*J. acoust. Soc. Amer.*, March 1948, Vol. 20, No. 2, pp. 221–222.) Summary only.

534.64 **2133**

Acoustic Impedance from Motional Impedance Diagrams.—R. D. Fay & J. E. White. (*J. acoust. Soc. Amer.*, March 1948, Vol. 20, No. 2, pp. 98–107.) When an acoustic load is coupled to an electromagnetic transducer by means of an air column, there is a critical length at which an increment in acoustic load produces a maximum increment of electrical impedance. A method is described which makes use of this critical coupling to obtain optimum precision in determining acoustic impedance. The characteristic impedance of the air column is directly measured.

534.64 **2134**

Acoustic Impedance Measurement of Very Porous Screen.—C. M. Harris. (*J. acoust. Soc. Amer.*, March 1948, Vol. 20, No. 2, p. 222.) Summary only. Equations are derived which express the impedance of the screen in terms of the acoustic characteristics of a small rectangular chamber or closed cylinder. Results for very porous cloth are given.

534.7 : 611.85 **2135**

Construction Material of the Sound Conduction System of the Human Ear.—H. G. Kobrak. (*J. acoust. Soc. Amer.*, March 1948, Vol. 20, No. 2, pp. 125–130.)

534.75 **2136**

The Atonal Interval.—I. Pollack. (*J. acoust. Soc. Amer.*, March 1948, Vol. 20, No. 2, pp. 146–149.) The difference between the thresholds of audibility and tonality for sinusoidal signals, the atonal interval, ranged from about 2.5 db at 500 c/s to about 6.5 db at 4 000 c/s.

534.75 **2137**

The Perception of Short Bursts of Noise.—G. A. Miller. (*J. acoust. Soc. Amer.*, March 1948, Vol. 20, No. 2, pp. 160–170.)

534.75 **2138**

The Perception of Repeated Bursts of Noise.—G. A. Miller & W. G. Taylor. (*J. acoust. Soc. Amer.*, March 1948, Vol. 20, No. 2, pp. 171–182.)

534.756 + 534.78 **2139**

New Possibilities in Speech Transmission.—D. Gabor. (*J. Instn elect. Engrs*, Part III, Jan. 1948, Vol. 95, No. 33, p. 39.) Discussion on 1228 of May.

534.78 **2140**

The Influence of Interaural Phase Relations upon the Masking of Speech by White Noise.—J. C. R. Licklider. (*J. acoust. Soc. Amer.*, March 1948, Vol. 20, No. 2, pp. 150–159.)

534.835 **2141**

Attenuation of Sound by Light-Weight Multiple Structures.—L. L. Beranek. (*J. acoust. Soc. Amer.*, March 1948, Vol. 20, No. 2, p. 222.) Summary only. The full paper presents theory and charts for the calculation of attenuation in typical aircraft and office partitions.

534.839 : 623.827 **2142**

A Sheet of Air Bubbles as an Acoustic Screen for Underwater Noise.—D. P. Loye & W. F. Arndt. (*J. acoust. Soc. Amer.*, March 1948, Vol. 20, No. 2, pp. 143–145.) Measurements of noise from submarines in dock could be made satisfactorily by use of a bubble screen across the open end of the dock. This effectively shut out external noise.

534.843 **2143**

The Acoustical Performance of Rooms.—H. W. Rudmose. (*J. acoust. Soc. Amer.*, March 1948, Vol. 20, No. 2, p. 225.) Summary only. Report of tests, in studios and rooms of average size, with equipment giving a.f. signals varying continuously in frequency and in bandwidth. The upper frequency limit was 15 kc/s and bandwidth varied from 15 c/s to 150 c/s. The minimum bandwidth for a smooth response for a polycylindrical (plywood) studio is very much less than that required for a rectangular studio with conventional acoustic treatment. Knowledge of the minimum bandwidth for smooth response may help to determine the diffusion of a room.

534.845 **2144**

Sound Absorption by Porous Materials : Part 1.—J. v. d. Eijk, C. W. Kosten & W. Kok. (*Appl. sci. Res.*, 1947, Vol. B1, No. 1, pp. 50–62.) Maximum absorption is obtained when there is a small airgap between the structural wall or ceiling and the absorbing material. A new interferometer is described and measurements of the effect of varying the airgap are given and discussed. Very small airgaps have a marked effect on the frequency at which maximum absorption occurs.

534.845.1 **2145**

A New Method for Measuring Sound Absorption.—C. W. Kosten. (*Appl. sci. Res.*, 1947, Vol. B1, No. 1, pp. 35–49.) The relation between the electric impedance of an electrodynamic loudspeaker and the acoustic impedance in front of the loudspeaker is given and discussed in detail. The consequences of the flexibility of the cone are studied. Simple formulae and graphs are given, connecting the electrical behaviour and the absorption coefficient corresponding to the load on the loudspeaker. The method seems to permit absorption measurements at low frequencies (50–500 c/s).

534.85 **2146**

Audio Noise Reduction System.—H. F. Olson. (*J. acoust. Soc. Amer.*, March 1948, Vol. 20, No. 2, p. 222.) Summary only. A threshold type for sound reproducing systems. A nonlinear element allows the useful signal to pass but discriminates against the noise.

534.851 **2147**

Dynamic Noise Suppression Circuits.—J. D. Goodell. (*Radio News*, Jan. 1948, Vol. 39, No. 1, pp. 46–48, 162.) For a similar paper see 1233 of May. See also 932 of April (Scott).

534.851 : 621.395.813 **2148**

Wow Meter for Turntable Testing.—G. L. Sansbury & E. W. Pappenfus. (*Electronics*, March 1948, Vol. 21, No. 3, pp. 108–111.) A toothed wheel, centred on the turntable and rotating between two pickup coils connected for maximum output, generates a tone. The output is fed through a peak clipper to a discriminator and rectifier. Instantaneous turntable speed variation is read directly on a calibrated meter.

534.86 **2149**

Does Distortion Matter ?—(*Wireless World*, March 1948, Vol. 54, No. 3, pp. 97–98.) Report of an I.E.E. discussion on the subject 'To what extent does distortion matter in the transmission of speech and music'. Points raised include the public reaction to an increased high-frequency response, the most desirable attenuation/frequency characteristic and the effect of rooms on reproduction.

534.862 : 621.317.755 **2150**

Cathode-Ray-Oscillograph Images of Noise-Reduction Envelopes.—B. H. Denney. (*J. Soc. Mot. Pict. Engrs*, Jan. 1948, Vol. 50, No. 1, pp. 37–49.) A method of presentation for use in sound-on-film work. An electronic switch generates repetitive pulses of a.f. signals and a second switch picks up these signals and the resulting noise-reduction-bias envelope, recording both in suitable positions on the oscillograph.

534.87 **2151**

The Magnetostrictive Radial Vibrator.—L. W. Camp. (*J. acoust. Soc. Amer.*, March 1948, Vol. 20, No. 2, p. 225.) Summary only. Description of apparatus for underwater signalling. A plastic cast for the toroidal windings improves the efficiency.

621.395.623.7 : 534.842 **2152**

A Proposed Loudness-Efficiency Rating for Loudspeakers and the Determination of System Power Requirements for Enclosures.—H. F. Hopkins & N. R. Stryker. (*Proc. Inst. Radio Engrs, W. & E.*, March 1948, Vol. 36, No. 3, pp. 315–335.) " Experimental and computed data relating to the loudness contribution of various ranges of the frequency spectra of speech and music are correlated with the corresponding energy distribution. A relatively simple measurement of sound pressure and a knowledge of certain acoustic radiation phenomena are applied to this correlation to form the basis of a method for predicting the loudness established by loudspeakers in enclosures. A loudness-efficiency rating for loudspeakers is suggested, and its application to sound-system engineering problems is described."

621.395.625 **2153**

The Development of Sound Recording and Reproduction.—E. T. Fisk. (*J. R. Soc. Arts*, 16th Jan. 1948, Vol. 96, No. 4760, pp. 105–117. Discussion, pp. 118–120.) A historical review, with discussion of the design, performance and scope of some modern film, disk and magnetic tape and wire recording systems.

621.395.625.3 **2154**

Build Your Own Magnetic Tape Recorder.—L. B. Hust. (*Radio News*, Feb. 1948, Vol. 39, No. 2, pp. 39–42..167.) Complete specifications for the construction of a recording and playback unit with a playing time of 30 minutes.

621.395.625.3 **2155**

Basic Amplifier for a Wire Recorder.—L. S. Hicks. (*Radio News*, Feb. 1948, Vol. 39, No. 2, pp. 44–45..169.)

621.395.92 **2156**

Models 65 and 66 Hearing Aids.—J. R. Power. (*Bell Lab. Rec.*, Jan. 1948, Vol. 26, No. 1, pp. 30–33.) Two compact, 3-stage instruments with built-in crystal microphones and weighing 6 oz and 8 oz respectively. Model 65 is suitable for persons with a small hearing loss. Model 66 is designed to provide maximum quality and output for anyone with correctable hearing. Additional amplification may be obtained with external batteries and the output characteristic may be modified by the use of alternative receivers.

621.395.92 **2157**

A Cavity Pressure Method for measuring the Gain of Hearing Aids.—E. L. R. Corliss & G. S. Cook. (*J. acoust. Soc. Amer.*, March 1948, Vol. 20, No. 2, pp. 131–136.) The sound pressure generated by the hearing-aid receiver is measured by placing the receiver on an 'artificial ear' coupler of volume 2 cm^3. Free-field and pressure techniques are compared. The pressure and free-field methods give results of comparable accuracy; from a practical standpoint the pressure method has decided advantages.

621.396.645.371.029.3 **2158**

Negative Feedback Compression.—J. T. Goode. (*Radio News*, Jan. 1948, Vol. 39, No. 1, pp. 118..139.) Experimental results for a simple circuit.

531 + 534] : 621.392 **2159**

Electromechanical and Electroacoustical Analogies and Their Use in Computations and Diagrams of Oscillating Systems. [Book Review]—B. Gehlshøj. G.E.C. Gad, Copenhagen, 142 pp., 12 kroner. (*Wireless Engr*, March 1948, Vol. 25, No. 294, p. 88.) Based upon work for a higher degree at the Royal Technical College of Denmark. " The treatment throughout is very clear and the book can be strongly recommended."

621.395.625.3 **2160**

Further Studies in Magnetophones and Tapes. [Book Notice]—F.I.A.T. Final Report No. 923. H.M. Stationery Office, London, 13th May 1947, 131 pp., 17s. 6d. A report of the investigation of German recorders, Models K7 and K4, and K7 as modified for broadcasting. Discussion of principles of operation, circuit diagrams, response curves and practical operating and maintenance. Recording, playback and erasing by an 80-kc/s tone are provided in a single unit. Details of the manufacture of three types of tape are included. See also 2320 of 1947 and back references.

AERIALS AND TRANSMISSION LINES

621.315.212 : 621.3.09 **2161**

The Propagation of Signals in a Coaxial Cable.—L. A. Zhekulin. (*Radiotekhnika, Moscow*, Jan./Feb. 1948, Vol. 3, No. 1, pp. 22–35. In Russian.)

621.315.212.011.2 **2162**

Study of the Impedance Irregularities of Coaxial Cables by Oscillographic Observation of Pulse Echoes : Part 1.—P. Herreng & J. Ville. (*Câbles & Transmission Paris*, April 1948, Vol. 2, No. 2, pp. 111–130. With English summary.) A theoretical treatment. The exact nature of the observed errors is discussed and theoretical considerations are developed which enable systematic errors to be eliminated and errors due either to irregularities of construction or to impedance unbalance to be correctly interpreted.

621.392.029.64 **2163**

Magic-Tee Waveguide Junction.—G. Saxon & C. W. Miller. (*Wireless Engr*, May 1948, Vol. 25, No. 296, pp. 138–147.) A mathematical analysis of the junction leads to an alternative explanation of the properties described by previous writers, and explains some additional properties. Performance data are included for a range of frequencies, and a modified construction is described whereby the useful frequency range may be extended. Applications of the junction include an impedance bridge, the measurement of s.w.r., transmission round awkward corners, phase shifting, frequency discrimination and frequency changing.

621.392.029.64 **2164**

Radiating Slits in Circular Waveguides.—Ya. N. Feld. (*Radiotekhnika, Moscow*, May/June 1947, Vol. 2, No. 5, pp. 42–54. In Russian, with English summary.) Equations are derived for the field within a waveguide with a longitudinal slit. Formulae are obtained for the voltage across such a slit and for the reflection coefficient in the waveguide due to the slit. If a metal partition is fixed beyond the slit, it is possible to obtain a system of travelling waves in the waveguide.

621.392.029.64 **2165**

Waveguide Hybrids.—W. A. Tyrrell. (*Bell Lab. Rec.*, Jan. 1948, Vol. 26, No. 1, pp. 24–29.) Discussion of a 4-arm junction. If a suitable wave front is passed into either of one pair of arms with high isolation from one another, then the output will be equally divided between the second pair. Impedance mismatch is eliminated by the use of rod and post tuning elements, the input arms being balanced with respect to each other provided that the output arms are symmetrically terminated.

This type of junction has been used successfully with a balanced converter, the incoming r.f. signal being applied to one of the input arms and the local oscillator connected to the other. The i.f. signal is equally divided between the output arms and is passed to two rectifier systems.

621.392.029.64 : 621.3.09 **2166**

Propagation Characteristics in a Coaxial Structure with Two Dielectrics.—A. Baños, Jr, H. Gruen & D. S. Saxon. (*Phys. Rev.*, 1st March 1948, Vol. 73, No. 5, p. 531.) Summary of Amer. Phys. Soc. paper. The propagation characteristics are expressed in terms of the ratio of the two dielectric constants, the ratio of the radii of the dielectrics, and the frequency. The possibility of adjusting the phase velocity by varying these parameters suggests application to linear accelerators.

621.392.43 **2167**

The Matching of High-Frequency Transmission Lines using a Frequency-Variation Method.—A. S. Edmondson. (*Proc. phys. Soc.*, Nov. 1947, Vol. 59, No. 336, pp. 982–989.) "The variation with frequency in the sending-end voltage of a transmission line many wavelengths long is reproduced on the screen of a cathode-ray oscilloscope and from the curve it is possible to see whether the standing waves along the line are large or small in amplitude, and how they vary with frequency. A description is given of an apparatus applying the new method to ultra-high frequencies and used in connection with the matching of aerials and filters to a coaxial transmission line. The method has also been used for demonstrating several important transmission line properties and in this connection is useful for educational purposes."

621.396.67 **2168**

Note on Carson's Theory of Reciprocity.—J. Maillard. (*Onde élect.*, Feb. 1948, Vol. 28, No. 251, pp. 77–81.) Discussion of the generalized form of the reciprocity theorem shows that the directivity and the bandwidth of an aerial are the same for transmission and reception, that the transmitter impedance corresponding to maximum radiation is the same as that of the receiver picking up maximum power, and that for two aerials the ratio of the maximum powers transmitted and picked up is independent of the sense of the transmission.

621.396.67 **2169**

The Comb Antenna.—R. Grimm. (*Proc. Inst. Radio Engrs, W. & E.*, March 1948, Vol. 36, No. 3, pp. 359–362.) The reception of vertically polarized m.f. waves by a comb aerial array is analysed. The formulae derived can be applied to any array in which the elements are arranged in line and in which the current ratios and phase relations are known. Close coupling of the elements greatly increases the directivity and signal level by adjusting the line velocity to an optimum value. This type of aerial is particularly suitable for the reception of loran signals.

621.396.67 **2170**

A Note on an Omni-Directional Array of Stacked V-Antennas.—T. P. Pepper. (*Canad. J. Res.*, Jan. 1948, Vol. 26, Sec. A, No. 1, p. 22.) Five V-aerials, each consisting of two mutually perpendicular end-fed $\lambda/2$ dipoles, with $\lambda/2$ spacing, were fed from a double coaxial transmission line. An approximately circular radiation diagram was obtained. Matching problems were very much simpler than for stacked-loop aerials.

621.396.67 **2171**

Cathode Follower TV-Antenna System.—E. G. Hills. (*Communications*, Jan. 1948, Vol. 28, No. 1, pp. 22 . . 32.) When the operating frequency changes, factors tending to reduce the efficiency of an array are : (*a*) change of electrical length of the feeder lines ; (*b*) change in element feed-point impedances when isolated from other elements; (*c*) change in mutual impedances between radiators ; (*d*) change in number of wavelengths in the spacing between the elements. (*a*) and (*d*) can be remedied together by making the effective path of the signal the same for all elements. (*b*) has been remedied in many broad-band aerials and also in the cathode-follower aerial. (*c*) can be minimized by reducing the currents in the various elements to a very low value by terminating the receiving element with the high input impedance of a cathode follower. Typical cathode-follower arrays are described. Signal/noise ratios and aerial gain are discussed.

Such arrays can only be used for reception and the gain is relatively low. There is the added disadvantage that a source of power is required to operate the valves.

621.396.67 : 517.512.2 **2172**

Fourier Transforms in Aerial Theory : Part 5—Fourier Approximation Curves.—Ramsay. (*See* 2270.)

621.396.671 **2173**

Calculation of the Input Impedance of a Special Antenna.—C. J. Bouwkamp. (*Philips Res. Rep.*, June 1947, Vol. 2, No. 3, pp. 228–240.) The aerial consists of a vertical $\lambda/4$ end-fed wire, with either two equal horizontal wires pointing in opposite directions from the feed point, or four equal horizontal wires pointing in perpendicular directions. Sinusoidal current distribution is assumed. The radiation resistance is about 20 Ω in each case.

621.396.671.4 **2174**

An Approximate Calculation of the Mutual Impedance of Aerials.—G. T. Markov. (*Radiotekhnika, Moscow*, Jan./Feb. 1948, Vol. 3, No. 1, pp. 36–39. In Russian.)

621.396.677 **2175**

A Wave Channel with Radiators of an Improved Shape.—S. I. Tetel'baum. (*Zh. tekh. Fiz.*, Oct. 1947, Vol. 17, No. 10, pp. 1181–1186. In Russian.) An u.s.w. directive receiving system consisting of a number of elementary dipoles is discussed theoretically and methods are indicated for determining their optimum arrangement. The operation of the whole link comprising the transmitting and receiving aerials is also considered.

621.396.677 **2176**

Metallic Delay Lenses.—W. E. Kock. (*Bell Syst. tech. J.*, Jan. 1948, Vol. 27, No. 1, pp. 58–82.) Focusing of microwaves is obtained by phase-velocity reduction, so that the lens is shaped like its optical counterpart. The reduced velocity is caused by the presence of conducting elements which behave like the molecular dipoles of a non-polar dielectric. If these elements are small compared with λ, the refractive index is constant over a wide frequency range.

Various experimental models using spherical and disk lattices, strip arrays and sprayed sheets are described, and design and performance details are given for a strip type lens suitable for microwave repeater systems. Directional properties and impedance match are stated to be superior to those of parabolic reflectors. Theoretical calculations of the expected dielectric constant are in fairly good agreement with experiment for values less than 1.5.

CIRCUITS AND CIRCUIT ELEMENTS

621.314.2 **2177**

A Note on a Parallel-Tuned Transformer Design.—V. C. Rideout. (*Bell Syst. tech. J.*, Jan. 1948, Vol. 27, No. 1, pp. 96–108.) Simple design formulae are obtained for a slightly over-coupled case. Theoretical performance data are included for: (*a*) a 'matched' transformer with resistance loading on each side; (*b*) the same transformer with the output load removed; (*c*) a transformer with loading on one side only, designed to have the same characteristics as the 'matched' transformer.

621.314.26 : 621.385.38 **2178**

Thyratron Frequency Changers.—O. E. Bowlus & P. T. Nims. (*Electronics*, March 1948, Vol. 21, No. 3, pp. 126–130.) Designed to permit parallel operation of 3-phase aircraft alternators driven at unequal and varying speeds.

621.314.3† **2179**

Magnetic Amplifier Characteristics — Neutral Type.—A. S. FitzGerald. (*J. Franklin Inst.*, Dec. 1947, Vol. 244, No. 6, pp. 415–439.) A description of the performance characteristics of amplifiers designed to actuate directly a moving armature relay. The minimum operating amplifier input lies in the range 6 μW to 0.1 μW.

Several graphs are given showing the gain and operating time characteristics for various amplifiers operating on 60 c/s or 720 c/s, or a combination of both. See also 960 of April, 1285 of May and 1567 of June.

621.316.726.078.3 : 621.396.615.142.2 : 538.569.4 **2180**

Frequency Stabilization of Microwave Oscillators by Spectrum Lines.—W. V. Smith, J. L. G. de Quevedo, R. L. Carter & W. S. Bennett. (*J. appl. Phys.*, Dec. 1947, Vol. 18, No. 12, pp. 1112–1115.) The method of stabilization is a development from that in which a cavity, tuned to the required frequency, controls the differential d.c. output from two crystal rectifiers in a waveguide bridge circuit, this output being applied to the oscillator to correct its frequency. In the present method the cavity is replaced by a short-circuited waveguide filled with a gas (e.g. ammonia) at low pressure. The differential output from the crystals is zero when the frequency is that giving maximum absorption; otherwise an error voltage is obtained. Frequencies just below 24 000 Mc/s can be maintained constant to about 1 Mc/s by use of one or other of three ammonia absorption lines. See also 1690 of 1947 (Pound).

621.316.728 **2181**

Designing Saturable-Core Reactors for Specific Uses.—C. Helber. (*Electronic Industr.*, Dec. 1947, Vol. 1, No. 12, pp. 4–5, 13.) The reactors were required for a.c. voltage regulators for inverters used in aircraft, but the simplified design has more general application. A simple graphical method is given for predicting the control characteristics.

621.317.729 **2182**

A Note on Frequency Transformations for Use with the Electrolytic Tank.—W. H. Huggins. (*Proc. Inst. Radio Engrs, W. & E.*, March 1948, Vol. 36, No. 3, pp. 421–424.) Two frequency transformations are described which transform the circular tank described in 3651 of 1945 (Hansen & Lundstrom) into either a rectangular or an elliptical tank. The rectangular tank is suitable for simulating highly-damped circuits with response extending over many octaves in frequency. The elliptical tank is suitable for representing band-pass circuits having characteristics symmetrical about a centre frequency.

621.318.42 **2183**

Minimum-Cost Chokes.—T. H. Oddie & J. L. Salpeter. (*Philips Res. Rep.*, Aug. 1947, Vol. 2, No. 4, pp. 281–312.) A method enabling the most economical dimensions, for given electrical specifications, to be found for a.c. chokes. Equations and tabulated data yielding the best solutions are given for rectangular types of choke, with and without limitations on the stacking height. Application of the method to chokes carrying d.c. with superimposed a.c. is briefly indicated.

621.318.572 **2184**

Decade-Ring Scaling Circuit.—L. Seren. (*Rev. sci. Instrum.*, Sept. 1947, Vol. 18, No. 9, pp. 654–659.) A counting circuit is described which has a resolving time of 1.9 μs for any two, and 3.7 μs for any three consecutive pulses. A triode and milliammeter are used for indication, instead of a c.r. tube. See also 2496 and 2497 of 1946 (Regener).

621.318.572 **2185**

A Scale-of-16 Counting Circuit.—P. Bassi & A. Loria. (*Elettronica*, Nov. 1947, Vol. 2, No. 9, pp. 347–349.) A circuit based on that of De Vault (*Rev. sci. Instrum.*, 1943, Vol. 14, p. 23) and comprising (*a*) input multivibrator with 6N7 double triode, (*b*) 4-stage scaling circuit with Type 79 double triodes, and (*c*) counting circuit with WE13 triode pentode.

621.318.572 : 518.5 **2186**

High-Speed *n*-Scale Counters.—T. K. Sharpless. (*Electronics*, March 1948, Vol. 21, No. 3, pp. 122–125.) Basic flip-flop and scale-of-two circuits are reviewed and the technique is extended to the design of ring and chain counters of higher scale. A cathode-pulsed *n*-scale circuit is described which requires no complex indicating schemes, eliminates counting errors and operates at speeds up to 180 000 pulses per sec.

621.392 **2187**

A Contribution to Linear Network Analysis.—D. K. C. MacDonald. (*Phil. Mag.*, Nov. 1946, Vol. 37, No. 274, pp. 778–789.) Analytical methods involving the application of sinusoidal, 'step' or Heaviside, and pulse stimuli are reviewed. An alternative exponential type of stimulus is described, and the resulting response, or 'exponential admittance', is compared with those obtained by other methods. The exponential admittances are obtained for the fundamental circuit elements and some of their simple combinations.

621.392 **2188**

A Table of Intermodulation Products.—C. A. A. Wass. (*J. Instn elect. Engrs*, Part III, Jan. 1948, Vol. 95, No. 33, pp. 31–39.) "An expression is derived from which, by substitution of appropriate numerical values, an equation can be obtained for any of the intermodulation products which can be generated by the simultaneous transmission of any number of sinusoidal waves through a device with an output/input characteristic like $V = a_1v + a_2v^2 + a_3v^3 + \ldots$ This expression is used as a basis for classification of products, and a table of representative products is drawn up. Information is given about the numbers and relative importance of products of different kinds."

621.392 : 512.831 **2189**

Matrix Methods in the Solution of Ladder Networks.—R. E. Vowels. (*J. Instn elect. Engrs*, Part III, Jan. 1948, Vol. 95, No. 33, pp. 40–50.) Matrix theory is reviewed and useful results and transformations are summarized. The solution of circuit equations by 'diagonalizing' the impedance matrix is developed, and applied to the solution of difference equations of ladder networks regarded as n similar T-sections in tandem.

621.392.4 **2190**

On the Synthesis of Bipoles by a Recurrence Method.—R. Leroy. (*Câbles & Transmission, Paris*, April 1948, Vol. 2, No. 2, pp. 101–110.) The impedance function should be a positive real function of $p = j\omega$. Brune's solution of the problem (1932 Abstracts, p. 280) involves the absolute minimum referred to the zero of the real part of the impedance on the frequency axis ; the method depends upon the sign of the reactive part. The zeros of the even part of the impedance, whatever their position in the p-plane, are discussed more generally. Brune's results are obtained without having to distinguish particular cases. By using zeros not situated on the frequency axis, recurrence methods are derived which only involve reactive elements.

621.392.5 **2191**

On the Theory of Quadripoles. Canonical Impedances and the Bisection Theorem.—L. Bouthillon. (*Ann. Radioélect.*, Jan. 1948, Vol. 3, No. 11, pp. 3–20.) The series and derived impedances of lattice equivalents are frequently used to define symmetrical quadripoles. The theory here given introduces these impedances under the name of canonical impedances, without particular reference to the lattice quadripole, which is only one type of the quadripoles equivalent to a given quadripole. A new demonstration of Cauer's theorem (1932 Abstracts, p. 537) is given and the idea of canonical impedances is extended to nonsymmetrical quadripoles. The filtering characteristics of the dipole are shown to be the same, in terms of canonical impedances, for both symmetrical and nonsymmetrical quadripoles. It may thus be possible to develop a general filter theory for both these classes. A new demonstration is given of Bartlett's bisection theorem and this is extended to antisymmetrical linkages. Particular cases are discussed and the theorem is applied (*a*) to the design of quadripoles whose canonical impedances are given ; a number of known types are at once found ; (*b*) to the study of quartz plates with four electrodes ; the characteristic impedances are calculated for various quadripoles which can be derived from such arrangements.

621.394/.397].645.3 : 621.314.25 **2192**

An Analysis of Three Self-Balancing Phase Inverters.—A. A. Rizkin. (*Radiotekhnika, Moscow*, Jan./Feb. 1948, Vol. 3, No. 1, p. 79. In Russian.) Comment on 1195 of 1946 (Wheeler). Rizkin claims that the circuit there described was patented by him on 28th May, 1940.

621.396.611 **2193**

An Inductance-Capacitance Oscillator of Unusual Frequency Stability.—J. K. Clapp. (*Proc. Inst. Radio Engrs, W. & E.*, March 1948, Vol. 36, No. 3, pp. 356–358.) The circuit is similar to the Colpitts, but an LC series circuit replaces the inductor. If connections to the valve are kept short, there is practically no tendency toward spurious oscillation. Stability depends on the frequency and reactances used. Frequency changes of less than 1 part in 10^6 have been observed for changes in supply voltages of $\pm 15\%$.

621.396.611.21 **2194**

Variable-Frequency Crystal Oscillators.—H. Stanesby & P. W. Fryer. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 12, pp. 368–378.) The frequency of a crystal oscillator can be varied very slightly by means of a variable capacitor. The range of variation may be substantially increased by associating inductance with the crystal plate. It is estimated that the range of variation, for a 3-Mc/s oscillator using an AT-cut plate, could be increased fivefold with added inductance, while preserving far better frequency stability than that of a tuned-circuit oscillator. Experiments confirmed that a range of 7.7 kc/s (2 560 parts in 10^6) could be obtained for one 3-Mc/s plate by using inductance. Circuits are described whereby the frequency can be made a linear function of the controlling reactance. The possibility of linear variation by means of a reactance valve is briefly considered. Applications are discussed.

621.396.611.21 **2195**

Crystal Oscillators and Their Application to Radio Transmitter Control.—J. L. Creighton, H. B. Law & R. J. Turner. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 12, pp. 331–344.) Discussion of the mechanism of operation of high-grade crystal oscillators, with particular reference to frequency stability. The crystal unit is described with special regard to the temperature performance obtainable from the various cuts used to cover a frequency range on fundamental modes of 4–20 000 kc/s. The drive circuit is analysed in order to establish stability criteria. Examples of practical designs are given.

621.396.611.4 **2196**

On a Cavity Resonator of High Quality for the Fundamental Frequency.—K. F. Niessen. (*Appl. sci. Res.*, 1947, Vol. B1, No. 1, pp. 18–34.) Q is evaluated for a cavity resonator whose cross-section is a parallelogram which can be divided into two isosceles right-angled triangles. Such a resonator can be used in a triode oscillator to prevent the occurrence of unwanted l.f. modes.

621.396.611.4 **2197**

Coupling Cavity Resonators through a Small Aperture.—V. V. Vladimirski. (*Zh. tekh. Fiz.*, Nov. 1947, Vol. 17, No. 11, pp. 1277–1282. In Russian.) The resonators have slightly different resonant frequencies. A system of equations (18) is derived from which the frequencies of the oscillations in each resonator and also the ratio of their amplitudes can be determined.

621.396.611.4 : 621.3.09 **2198**

The Propagation of Radio Waves along a Chain of Cylindrical Cavity Resonators.—V. V. Vladimirski. (*Zh. tekh. Fiz.*, Nov. 1947, Vol. 17, No. 11, pp. 1269–1276. In Russian.) Formulae (39) and (40) are derived for determining the phase and group velocities of an e.m. wave, the resonators being coupled through small apertures.

621.396.611.4.029.63 **2199**

Simplified Oscillators for 2 300 Mc/s.—A. R. Koch. (*QST*, Feb. 1948, Vol. 32, No. 2, pp. 11–14.) Detailed construction of a $3\lambda/4$ cavity resonator with output coupling loop, and of a $\lambda/2$ resonator with a capacitance-probe output connection.

621.396.615 **2200**

The Theory of an Oscillator coupled to a Long Feeder, with Applications to Experimental Results for the Magnetron.—C. Domb. (*Proc. phys. Soc.*, Nov. 1947, Vol. 59, No. 336, pp. 958–972.) Two cases are considered :—(*a*) The static case when the feeder is short enough for the time of travel of the wave to and fro along it to be small compared with the time of rise of the oscillation. The frequency and amplitude of a steady solution are first obtained ; the initial rise of oscillations and the effect of aerial coupling circuits are deduced. The theory is compared with recent experimental frequency/power curves. (*b*) The dynamic case when the feeder is long enough for the propagation time to be of importance. The steady solutions are shown to be the same as in case (*a*) and approximations are deduced which are useful when the a.m. is small and the initial f.m., before the oscillator settles down, is of prime importance.

621.396.615 **2201**

Oscillator with External Limitation of Amplitude.—N. F. Vollerner. (*Radiotekhnika, Moscow,* May/June 1947, Vol. 2, No. 5, pp. 34–41. In Russian, with English summary.) General description, with method of plotting the voltage waveform for continuous oscillations when operating on the linear portion of the valve characteristic with a linear limiter.

621.396.615 **2202**

Tests of the 6L6 as Oscillator, Frequency Multiplier, and Amplifier.—L. Liot. (*Télévis. franç.*, March 1948, No. 35, Supplement *Électronique*, pp. 16–18, 20.) The differences between the 6L6 (metal valve), 6L6G (glass valve) and 6L6GX (glass valve with steatite base) are outlined and circuits are given, using 6L6G, for three types of crystal oscillator, simple frequency multiplier and push-push doubler, and a class-C amplifier.

621.396.615.12 **2203**

Single-Valve A.F. Oscillator.—K. C. Johnson. (*Wireless World*, March 1948, Vol. 54, No. 3, pp. 82–84.) A simple RC circuit comprises a modified parallel-T phase-shift network and a double-triode amplifier which automatically limits amplitude of oscillation. Frequency coverage 35–16 000 c/s in two ranges. Output 3 V r.m.s., constant within 10%.

621.396.615.17 **2204**

Producing High-Frequency Pulses.—R. D. Carman. (*Wireless Engr*, May 1948, Vol. 25, No. 296, p. 164.) The method involves the use of a class-C amplifying valve which passes current only at the positive peaks of the excursions of the grid voltage. These peaks appear as pulses in the output. A pulse recurrence frequency of 5 Mc/s has thus been obtained. Still higher frequencies should be possible with a suitably designed load impedance.

621.396.619 **2205**

" Lagrangean " Formulae for the Direct Calculation of Harmonic Output and of Intermodulation Products.—A. Bloch. (*Phil. Mag.*, Oct. 1946, Vol. 37, No. 273, pp. 694–700.) The use of interpolation formulae to determine the anode current of a valve when the grid voltage varies sinusoidally. For earlier work see 2163 and 2852 of 1946; see also 3872 of 1940 (Espley).

621.396.645 **2206**

Cathode-Follower Gate Circuit.—J. Kurshan. (*Rev. sci. Instrum.*, Sept. 1947, Vol. 18, No. 9, pp. 647–649.) A double triode is operated as a cathode follower, the signal being applied to one grid and the gating pulse to the other. Leakage is low and practically independent of pulse amplitude. Possible applications suggested include coincidence counters and the separation of synchronizing signals in television reception.

621.396.645 **2207**

Some Designs and Applications for Packaged Amplifiers using Subminiature Tubes.—B. Chance, J. N. Thurston & P. L. Richman. (*Rev. sci. Instrum.*, Sept. 1947, Vol. 18, No. 9, pp. 610–616.) Design and construction details are given for both d.c. and a.c. amplifiers. Applications to control and measurement circuits are considered, and ways in which the use of such amplifiers can save time in the construction and repair of electronic apparatus are discussed.

621.396.645 **2208**

Utility Amplifier Unit.—T. A. Patterson, Jr. (*Radio News*, Jan. 1948, Vol. 39, No. 1, pp. 42–43.) Circuit and component values for a 3-stage high-fidelity audio amplifier.

621.396.645 **2209**

Some Characteristics of a Delay-Line-Coupled Wide-Band Pulse Amplifier.—H. G. Rudenberg. (*Phys. Rev.*, 1st March 1948, Vol. 73, No. 5, p. 543.) Summary of Amer. Phys. Soc. paper. A number of valves may be used in parallel, the control grids being coupled to the nodes of one artificial delay line and the anodes similarly coupled to a second identical line. A stage gain of 2.7 permits optimum use of valves. A bandwidth of over 40 Mc/s has been obtained with a single stage using six valves, each having a 30-pF capacitance shunting the electrodes.

621.396.645.012.2 **2210**

Circle Diagrams for Cathode Followers.—J. M. Diamond. (*Proc. Inst. Radio Engrs, W. & E.*, March 1948, Vol. 36, No. 3, pp. 416–420.) Universal circle diagrams are developed which determine the gain, input admittance, and output impedance. The variables are transconductance and the components of the cathode load. The Colpitts oscillator is considered as a cathode follower, and is analysed both algebraically and with the aid of circle diagrams.

621.396.645.36 **2211**

Push-Pull Input Circuits : Part 3 — Phase Reversers.—W. T. Cocking. (*Wireless World*, March 1948, Vol. 54, No. 3, pp. 85–87.) A comprehensive account of two typical phase-reversal circuits. Expressions are derived for the unbalance in amplitude and phase-shift of the output voltages, for each circuit. Phase unbalance up to 12% in the a.f. range is an undesirable feature in both cases. Parts 1 & 2, 1325 of May. Parts 4 & 5, 2212 below.

621.396.645.36 **2212**

Push-Pull Input Circuits : Parts 4 & 5.—W. T. Cocking. (*Wireless World*, April & May 1948, Vol. 54, Nos. 4 & 5, pp. 126–130 & 183–186.)

Part 4. The basic circuit of the anode-follower phase reverser is discussed and variants are considered. Formulae are derived for the unbalance at high, medium, and low frequencies. The advantages of this type of circuit are outlined.

Part 5. In cathode coupling the input signal is applied to the grid of one triode and a second triode is driven from the first by means of a common cathode resistor. The output signals from the two anodes are out of phase and can be made nearly equal in magnitude. Unbalance effects are again analysed. Part 3, 2211 above. Parts 1 & 2, 1325 of May.

621.396.645.371 **2213**

Multi-Channel Radio-Frequency Amplifiers.—R. F. J. Jarvis & R. A. Brockbank. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 12, pp. 389–397.) Discussion of war-time developments in wide-band feedback amplifier design. With existing valves, network performance at frequencies up to 50 Mc/s is approaching the theoretical limit. A representative selection of amplifiers developed to meet urgent specific demands is described; these range from a highly stable (60-db feedback) 100-mW repeater for speech channels on a coaxial cable, to a transmitter amplifier capable of feeding 12 simultaneous 40-W telegraph signals, in the frequency band 3–8 Mc/s or 8–15 Mc/s, direct into a rhombic aerial. The importance of Bode's analysis (4231 of 1940) of feedback amplifier networks is stressed.

621.396.645.371 **2214**

A Response-Compensated 6L6 Amplifier.—(*Radio & Electronics, Wellington, N.Z.*, 1st Jan. 1948, Vol. 2, No. 10, pp. 8–12, 56.) A 5-stage amplifier incorporating two 6L6 valves in class-A push-pull provides an output of 18.5 W with a peak input of 0.87 V. Overall negative feedback gives a frequency response flat within ± 1 db from 20 to 10 000 c/s. Independent high- and low-frequency boost is provided.

621.396.662.3 **2215**

A New Crystal Channel Filter.—E. S. Willis. (*Bell Lab. Rec.*, Jan. 1948, Vol. 26, No. 1, pp. 13–17.) Details of the construction and performance of an improved single-lattice filter of economical design for use with broad-band carrier systems. Glass-sealed crystal units are used in a bridge type of circuit.

621.396.662.3.029.64 **2216**

A Non-Reflecting Branching Filter for Microwaves.—W. D. Lewis & L. C. Tillotson. (*Bell Syst. tech. J.*, Jan. 1948, Vol. 27, No. 1, pp. 83–95.) The branching filter is required in microwave repeater stations to pass each frequency band into an appropriate waveguide channel. High selectivity is unnecessary, but low loss and good impedance match are essential. The filter described diverts each unwanted frequency band into a resistive termination. This is achieved by an assembly of two waveguide 'hybrids' and two reflection filters. *N* such assemblies constitute an *N*-channel branching network.

The mechanical and electrical characteristics of a satisfactory 5-channel system are described. The overall s.w.r. is less than 0.6 db and insertion loss less than 1.0 db. Discrimination against other channels is at least 20 db.

621.396.69 + 621.317.7 + 621.38 **2217**

Physical Society's Exhibition.—(*Wireless Engineer*, May 1948, Vol. 25, No. 296, pp. 157–162; *Wireless World*, May 1948, Vol. 54, No. 5, pp. 174–179.) Short descriptions of some of the exhibits.

621.396.69 : 06.064 **2218**

Progress in Components. Review of the R.C.M.F. [Radio Components Manufacturers' Federation] **Exhibition.**—(*Wireless World*, April 1948, Vol. 54, No. 4, pp. 131–137.) A survey of productions in the main categories, with a list of exhibitors and their addresses. For other accounts see *Electronic Engng*, April 1948, Vol. 20, No. 242, pp. 114–117, and 1896 of July.

621.396.822 **2219**

Statistical Properties of a Sine Wave plus Random Noise.—S. O. Rice. (*Bell Syst. tech. J.*, Jan. 1948, Vol. 27, No. 1, pp. 109–157.) An extension of part of an earlier paper (440, 2168 and 2169 of 1945). The current may be written as $I = R \cos(qt + \theta)$. The probability density of I and the time derivative θ' of the phase angle θ, the crossings of I, R, θ and θ' and the correlation function and power spectrum of θ' are investigated.

"It is believed that some of the material presented here may find a use in the study of the effect of noise in frequency modulation systems."

621.396.822 **2220**

Noise in Resistances and Electron Streams.—J. R. Pierce. (*Bell Syst. tech. J.*, Jan. 1948, Vol. 27, No. 1, pp. 158–174.) The following aspects of noise are discussed in terms of simple physical pictures, using non-rigorous mathematics: (*a*) Johnson noise in resistors; (*b*) shot noise, for which an expression is derived by a new method; (*c*) noise produced by bunching in electron multipliers; (*d*) reduction of noise in diodes due to space charge; (*e*) noise in triodes and pentodes.

621.314 **2221**

Electronic Transformers and Circuits. [Book Review]—R. Lee. John Wiley & Sons, New York, 1947, 282 pp., $4.50. (*Proc. Inst. Radio Engrs, W. & E.*, March 1948, Vol. 36, No. 3, p. 383.) "A detailed, meticulous exposition of the design of transformers for electronic circuits."

621.392 + 621.385 **2222**

Electronic Circuits and Tubes. [Book Review]—War Training Staff of the Cruft Laboratory, Harvard University. McGraw Hill Publishing Co., London, 948 pp., 45s. (*Wireless World*, April 1948, Vol. 54, No. 4, pp. 151–152.) "A number of different authors are responsible for different chapters . . . Some chapters are extremely detailed and very thorough, others are much more elementary and of a rather superficial character."

GENERAL PHYSICS

530.145 **2223**

The Theory of Radiation Damping.—J. Hamilton. (*Proc. phys. Soc.*, Nov. 1947, Vol. 59, No. 336, pp. 917–940.) An attempt to get a better understanding of the quantum theory of radiation damping developed by Weisskopf & Wigner, Heitler & Peng, and Wilson. By considering the emission from an atom enclosed in a cubical box with perfectly reflecting walls, and the scattering of a photon or a meson by electrons or nucleons inside a similar box, the emission and scattering problems are solved for the discrete energy level case, subject to certain limitations. The addition of some physically unimportant states to the equations of the emission problem reduces the divergence difficulties in the radiation theory of the phenomenon. In general, however, it seems impossible to use the discrete energy method to investigate whether or not the divergencies in radiation theory are purely mathematical difficulties due to the neglect of higher-order processes.

537.291 **2224**

On Using the Energy of Electrons moving in H.F. Uniform Electric Fields.—Neiman. (*See* 2407.)

537.525.3 **2225**

Positive and Negative Point to Plane Corona.—L. B. Loeb & W. N. English. (*Phys. Rev.*, 1st March 1948, Vol. 73, No. 5, p. 532.) Summary of Amer. Phys. Soc. paper. A comparison of positive and negative corona in air in the pressure range 205–760 mm Hg. Minimum corona voltages are slightly higher for a negative point; the two cases differ slightly in the form of the variation with pressure. Preliminary experiments with non-metallic points gave unexpected results.

537.527 : 536.2 **2226**

Influence of Cooling Conditions on High-Pressure Discharges.—W. Elenbaas. (*Philips Res. Rep.*, June 1947, Vol. 2, No. 3, pp. 161–170.) A detailed theoretical discussion for discharges in closed tubes and in free air. Experimental results for tube discharges confirm the theory.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

522/523 **2227**

Recent Developments in Astronomy.—M. W. Ovenden. (*J. Brit. interplanetary Soc.*, March 1948, Vol. 7, No. 2, pp. 70–91.) A review of observation results and modern theories.

523.72.029.6 : 523.746 : 621.396.822 **2228**

Solar Radio Emissions and Sunspots.—I. L. Thomsen : M. Ryle. (*Nature, Lond.*, 24th Jan. 1948, Vol. 161, No. 4082, pp. 134–136.) The ratio of the equivalent source temperatures deduced from radiation measurements on 80 Mc/s and 175 Mc/s by Ryle & Vonberg (96 of January) is correlated with sunspot records. There is good general agreement and it is suggested that the emission from the undisturbed sun gives an equivalent temperature proportional to a lower power than λ^2.

Ryle points out that the mean ratio of minimum equivalent temperatures obtained for the above frequencies during the past 11 months is about 2.2. Further evidence of periodicities in the ratio T_{80}/T_{175} has been obtained.

523.72.029.6 : 621.396.822 **2229**

On the Conditions of Escape of Microwaves of Radio-Frequency Range from the Sun.—M. N. Saha, B. K. Banerjea & U. C. Guha. (*Indian J. Phys.*, Oct. 1947, Vol. 21, No. 5, pp. 199–221.) The conditions governing solar emission are discussed with reference to magneto-ionic theories of propagation of radio waves through an ionized atmosphere traversed by a magnetic field. The magnetic field of the spots enables the *e*-component of the waves to escape from deeper layers of the solar atmosphere, and this explains emission of r.f. energy by the spot regions themselves. The theories give a general explanation of circular polarization, and of the sudden intensification of emission with the occurrence of flares. See also 1626 of June (Denisse).

523.72.029.64 : 621.396.822 **2230**

Emission of Enhanced Microwave Solar Radiation.—R. G. Giovanelli. (*Nature, Lond.*, 24th Jan. 1948, Vol. 161, No. 4082, pp. 133–134.) Outline of a theory assuming emission of radiation by spiralling electrons. The theory is similar to that given by Kiepenheuer, but involves a different origin for the energy. The mechanism whereby electrons may gain energies much greater than thermal, and the resulting intensity of the radiation received at the earth, are considered.

523.746 **2231**

Alfvén's Theory of Sunspots.—T. G. Cowling. (*Mon. Not. R. astr. Soc.*, Vol. 106, No. 5, pp. 446–456.) Alfvén's theory (3469 of 1945) is shown to be internally inconsistent, or inconsistent with observation, at many points. See also 3470 and 3796 of 1945 (Walén).

523.746.5 : 519.24 **2232**

New Statistical Method of predicting Sunspots aids Radio Propagation Forecasts.—(*J. Franklin Inst.*, Dec. 1947, Vol. 244, No. 6, pp. 481–487.) The method is based on data for a number of previous 11-year cycles. The importance of sunspot number in radio propagation is emphasized. The method is probably applicable to a wide variety of cyclical phenomena, such as long-term weather variations and climatic changes.

537.591 **2233**

New Italian Cosmic Ray Laboratory.—(*Nature, Lond.*, 14th Feb. 1948, Vol. 161, No. 4085, p. 254.) Some details of the situation, equipment and programme of work of a laboratory at a height of 11 500 ft on the upper slopes of Monte Rosa. It was opened in January.

550.384 : 523.745 **2234**

Geomagnetic ' Crochet ' Occurrence at Abinger, 1936-1946, and Allied Solar and Radio Data.—H. W. Newton. (*Mon. Not. R. astr. Soc., Geophys. Supplement*, Vol. 5, No. 6, pp. 200–215 : summary in *Mon. Not. R. astr. Soc.*, Vol. 106, No. 5, p. 465.) An investigation of ultra-violet solar radiation effects and their relation to solar flares and radio fade-outs. Diurnal and seasonal factors are discussed. Some ' crochets ' in 1946 have coincided with reported bursts of solar noise.

550.384 : 523.746 **2235**

' Sudden Commencements ' in the Greenwich Magnetic Records (1879-1944) and Related Sunspot Data.—H. W. Newton. (*Mon. Not. R. astr. Soc., Geophys. Supplement*, Vol. 5, No. 6, pp. 159–185 : summary in *Mon. Not. R. astr. Soc.*, Vol. 106, No. 5, p. 464.) The average amplitude, direction of impulse, and hourly and monthly frequencies of ' sudden commencements ' (SC) are derived from 681 cases identified from the Greenwich magnetograms over six sunspot cycles.

The relation of SC occurrence to the sunspot cycle and to individual sunspots is investigated. A sample comparison of SC pulses on magnetograms for Abinger and Lerwick shows remarkable similarity between the records of these stations during inactive periods.

551.5 : 621.396 **2236**

Meteorology and Radio.—A. Perlat. (*Onde élect.*, Feb. 1948, Vol. 28, No. 251, pp. 44–54.) Applications of radio to modern meteorology are reviewed, well known types of apparatus being merely mentioned, and the effect of meteorological conditions in the lower atmosphere on u.s.w. propagation is discussed.

551.510.52 : 621.396.812.029.64 **2237**

Radar Reflections from the Lower Atmosphere.—M. W. Baldwin, Jr. (*Proc. Inst. Radio Engrs, W. & E.*, March 1948, Vol. 36, No. 3, p. 363.) Comment on 722 of March (Gould). See also 2769 of 1947 (Friis).

551.510.535 **2238**

Experimental Determination of the [ionospheric] **Gyrofrequency.**—S. L. Seaton. (*Science*, 21st Nov. 1947, Vol. 106, No. 2760, pp. 496–497.) Vertical-incidence records made in Alaska indicate that both the longitudinal and transverse modes of propagation predicted by magneto-ionic theory occur simultaneously. The theory is used to calculate the gyrofrequency at heights corresponding to the sporadic-E, F_1 and F_2 regions. Above 200 km, agreement with the inverse-cube law is good for the longitudinal mode, but the transverse mode gives values consistently 0.08 Mc/s too high. Between 110 km and 160 km the observed values of gyrofrequency are too high, and the change of gyrofrequency with height is greater than that predicted by the inverse-cube law. This is possibly due to currents flowing in the lowest 100 km.

551.510.535 **2239**

Variation of Electronic Density in the Ionosphere with Latitude.—S. S. Banerjee & R. N. Singh. (*Sci. Culture*, Jan. 1948, Vol. 13, No. 7, p. 295.) Monthly ionosphere observations show that noon electron densities in the F_2 layer decrease near the equator ; this is attributed in part to the increased temperature of the ionosphere in the equatorial region.

551.510.535 **2240**

An Improved Ionospheric Height Recorder.—H. A. Thomas & R. G. Chalmers. (*J. Instn elect. Engrs*, Part III, Jan. 1948, Vol. 95, No. 33, pp. 7–13.) " The system comprises a transmitter, which scans a wide frequency range some twenty-five times per second, and a receiver which is tuned slowly through the same range. Each time the frequency of the transmitter passes through the pass-band of the receiver, a pulse is produced which is displayed on an oscillograph, together with other pulses produced by waves reflected from the ionosphere. The advantages of this technique are enumerated." A photographic record, covering the range 2–16 Mc/s, may be obtained automatically in a few seconds. The equipment has been designed with a view to duplication, and is semi-portable.

551.510.535 : 523.5 : 621.396.11.029.62 **2241**

Reflections of Very-High-Frequency Radio Waves from Meteoric Ionization.—Allen. (*See* 2328.)

551.510.535 : 551.594.5 **2242**

On the First Observations of the Night Ionized Layer lying above the F_2 Layer.—A. N. Kazantsev. (*C. R. Acad. Sci. U.R.S.S.*, 21st Jan. 1948, Vol. 59, No. 3, pp. 479–482. In Russian.) An ionospheric layer lying above the F_2 layer (at a height of 430 km) and possessing lower critical frequencies was observed in 1933–1937. See also 2243 below.

551.510.535 : 551.594.5 **2243**

Ionospheric Disturbances of a Special Type.—N. V. Mednikova. (*C. R. Acad. Sci. U.R.S.S.*, 21st Jan. 1948, Vol. 59, No. 3, pp. 475–478. In Russian.) An aurora was observed near Moscow on 16th February 1947, a comparatively rare phenomenon. Observations of the ionosphere carried out at the time showed the appearance of an additional layer above the F_2 layer. See also 2242 above.

551.594.5 **2244**

Interpretation of Radio Echoes from Polar Auroras.—N. Herlofson. (*Nature, Lond.*, 20th Dec. 1947, Vol. 160, No. 4077, pp. 867–868.) The results obtained by Lovell, Clegg & Ellyett (422 of February) are used to show that the electron density of the aurora must lie between 2.6×10^7 and 4×10^4 electrons/cm^3 if the reflecting surface is assumed to be plane. For a diffuse boundary the reflection coefficient is reduced by a factor of the order of 10^6 when the electron density is near the upper limit. The aurora boundaries would appear to be sharp to within a few metres.

551.594.5(47) **2245**

Aurora in Southern Siberia.—I. V. Zykov. (*Priroda*, 1947, No. 3, pp. 49–50. In Russian.) During the night of 28th/29th Sept. 1946 an aurora was clearly seen in the Kuzbass region (55° 30′ N, 87° 40′ E). Aurorae are rarely observed at such low latitudes and therefore a detailed description is given. It was accompanied by a sharp change from rainy to anticyclonic weather, with high pressure and night temperature below freezing point.

LOCATION AND AIDS TO NAVIGATION

621.396.93 : 621.396.677 **2246**

Recent Advances in Aerial Balancing Technique and Radiogoniometer Design in Relation to High Frequency Direction Finders.—S. A. W. Jolliffe & D. Watson. (*Marconi Rev.*, Oct./Dec. 1947, Vol. 10, No. 87, pp. 142–156.) The causes of instrumental error in the aerial and radiogoniometer system of an Adcock d.f. system are considered. A method of balancing such a system without introducing spurious effects due to bad siting of a local transmitter is described, and this method is compared with other techniques. A f.m. field transmitter for speedy and accurate calibration of wide-band h.f. direction finders is described. " Errors in the radiogoniometer due to the ' vector sum ' component of the voltage induced in the aerials are considered. Methods of reducing coupling law errors are given, and a balanced potentiometer which produces accurate voltage ratios for error curve tests is described."

621.396.932 **2247**

The Second International Meeting on Radio Aids to Marine Navigation : New York and New London.—R. B. Michell. (*J. Inst. Nav.*, Jan. 1948, Vol. 1, No. 1, pp. 69–75.) A summary of the main items discussed at the conference. The conclusions and recommendations adopted are given in an appendix. First conference noted in 3135 of 1947 and 112 of January.

621.396.932 **2248**

Douglas Harbour Radar.—(*Wireless World*, April 1948, Vol. 54, No. 4, p. 130.) A 3-cm radar system for control of shipping passing in and out of the harbour has been installed. The transmitter and receiver are housed at the base of a 60-ft tower at the harbour mouth, and a p.p.i. display unit is fitted in the harbour master's control room. Ranges of 3, 1.2 and 0.8 miles are provided. See also *Engineer, Lond.*, 5th March 1948, Vol. 185, No. 4806, p. 240.

621.396.933 **2249**

New Radio Aids to Aerial Navigation.—J. Fagot. (*Onde élect.*, Jan. & Feb. 1948, Vol. 28, Nos. 250 & 251, pp. 3–12 & 70–76.) A short description of the principles of operation of equipment demonstrated at Indianapolis in October 1946 prior to the P.I.C.A.O. conference in Montreal.

621.396.933 **2250**

Radio Aids to Navigation.—R. Watson-Watt. (*J. Inst. Nav.*, Jan. 1948, Vol. 1, No. 1, pp. 15–21.) A brief survey of the principles and limitations of existing aids and a discussion of probable future developments. It is suggested that the main impediment to the rapid development of satisfactory aids is lack of general understanding of their importance.

621.396.933 : 526.918.5 **2251**

Shoran for Surveying.—W. F. Kroemmelbein. (*Electronics*, March 1948, Vol. 21, No. 3, pp. 112–117.) Operation principles, circuits and application techniques.

621.396.933.24 **2252**

Consol.—A. H. Jessell. (*J. Inst. Nav.*, Jan. 1948, Vol. 1, No. 1, pp. 29–39.) A navigation aid consisting of a m.f. beacon radiating a pattern of dots and dashes which changes at regular intervals. By listening to this pattern a navigator can determine his position to a much greater accuracy than with a d.f. loop. The operation of the beacon and the method used to determine its bearing from the receiving point are described. For another account see 2912 of 1946 (Clegg).

621.396.96 : 531.381 **2253**

A Problem in Dynamic Balancing of Scanners for Radar. —C. Fox. (*Phil. Mag.*, Dec. 1946, Vol. 37, No. 275, pp. 830–842.) Theoretical conditions for dynamic balancing with spiral scanning are deduced, and practical arrangements fulfilling these conditions are described.

621.396.96 : 551.594.6 **2254**

Radar and Weather.—B. A. Shlyamin. (*Priroda*, 1947, No. 3, pp. 50–52. In Russian.) The use of 3-cm radar for locating distant storms, warm and occluded fronts and typhoons is considered. Typical images obtained and possible practical applications are discussed.

621.396.933 **2255**

Radar Aids to Navigation. [Book Review]—J. S. Hall, L. A. Turner & R. M. Whitmar (Eds). McGraw-Hill Book Co., New York, 1947, 382 pp., $7.50. (*Proc. Inst. Radio Engrs, W. & E.*, March 1948, Vol. 36, No. 3, p. 383.) " Should be of particular interest to those who deal with navigational problems and who were not closely associated with the wartime developments."

MATERIALS AND SUBSIDIARY TECHNIQUES

533·5 **2256**

Vacuum Pumping Equipment and Systems.—H. M. Sullivan. (*Rev. sci. Instrum.*, Jan. 1948, Vol. 19, No. 1, pp. 1–15.) "Typical rotary mechanical pumps, booster pumps, and diffusion pumps available to-day are described. Fundamental operating principles are discussed. The method for making theoretical computations of the conductance and speed of evacuation of a vacuum system is outlined."

533·5 **2257**

Diffusion Pumps: A Critical Discussion of Existing Theories.—D. G. Avery & R. Witty. (*Proc. phys. Soc.*, Nov. 1947, Vol. 59, No. 336, pp. 1016–1030.) "The original work of Gaede and others on diffusion pumps is briefly described. A critical discussion of this work leads to the formulation of a more complete theory of the action of the diffusion pump, and this is used to explain the practical characteristics of a simple form of modern diffusion pump."

535·37 **2258**

Fluorescence of Silicate Phosphors.—K. H. Butler. (*J. opt. Soc. Amer.*, July 1947, Vol. 37, No. 7, pp. 566–571.) A theory relating this fluorescence to the energy levels of the activator ions, and giving a better explanation of several phenomena than the impurity theory.

535·37 **2259**

Luminescence of Solid Solutions of the System $CaMoO_4$-$PbMoO_4$ and of Some Other Systems.—F. A. Kröger. (*Philips Res. Rep.*, June 1947, Vol. 2, No. 3, pp. 183–189.) "The systems (Ca, Sr)WO_4, (Ca, Sr)MoO_4, and (Ca, Mg)WO_6 are shown to behave as (Zn, Mg)WO_4 whereas (Ca, Pb)MoO_4 behaves as (Ca, Pb)WO_4." See also 2260 below.

535·37 : 541.123.6 **2260**

Photoluminescence in the Quaternary System $MgWO_4$-$ZnWO_4$-$MgMoO_4$-$ZnMoO_4$.—F. A. Kröger. (*Philips Res. Rep.*, June 1947, Vol. 2, No. 3, pp. 177–182.) Fluorescence and absorption are discussed for the four different crystal structures of this system. See also 2259 above.

535·37 : 621.327.43 **2261**

On the Quantum Output of the Luminescence of Certain Silicates, Tungstates and Borates.—D. A. Shklover. (*Zh. tekh. Fiz.*, Nov. 1947, Vol. 17, No. 11, pp. 1239–1252. In Russian.) An experimental investigation to determine the luminescent outputs of the main luminophores used in fluorescent lamps. The luminophores were excited by the 2 537-Å resonance line of mercury. The spectral energy distribution and the absorption coefficients for ultra-violet and visible radiations were also measured.

546.431.82 : 621.315.61 **2262**

The Effective Permittivity of Two-Phase Systems.—D. F. Rushman & M. A. Strivens. (*Proc. phys. Soc.*, Nov. 1947, Vol. 59, No. 336, pp. 1011–1016.) The preparation of samples of $BaTiO_3$ of varying porosity and measurements of their effective permittivity are discussed. The results are explained in terms of Wiener's mixture law.

546.431.82 : 621.317.3.011.5 **2263**

Dielectric Residual Effects in Titanates.—J. R. Partington, G. V. Planer & I. I. Boswell. (*Nature, Lond.*, 20th Dec. 1947, Vol. 160, No. 4077, pp. 877–878.) A study of the changes with time in permittivity and dielectric loss after a high, unidirectional electric field had been applied to $BaTiO_3$ and related compounds having structures of the perovskite type. Within the temperature range corresponding to a distorted perovskite structure a temporary increase in permittivity was obtained, while in the region of a cubic structure a temporary decrease was generally observed.

621.315.591† **2264**

The Physics of Electronic Semiconductors.—G. L. Pearson. (*Bell Syst. tech. Publ. Monogr.*, B-1475, 6 pp.) The band theory of solids is used to explain the following properties of electronic semiconductors: (*a*) dependence of specific resistance on impurity content; (*b*) negative temperature coefficient; (*c*) sign of the Hall and thermoelectric effects; (*d*) direction of rectification. The specific resistivity and the Hall coefficient are measured for Si, and the results used to calculate the density, mobility and mean free path of the electron carriers, as a function of temperature and impurity.

621.315.591.5† **2265**

Semi-Conductors with Large Negative Temperature Coefficient of Resistance.—E. J. W. Verwey, P. W. Haayman & F. C. Romeyn. (*Philips tech. Rev.*, 1947/1948, Vol. 9, No. 8, pp. 239–248.) Crystals of Fe_3O_4 are mixed with certain substances of the same crystal structure. The advantages of the resulting semiconductors over the normal resistor materials are (*a*) better manufacturing tolerances; (*b*) much more stable electrical properties; (*c*) high absolute value of temperature coefficient, about 10 times that of a metal. Practical applications include limitation of surge current, voltage stabilization, and resistance thermometry. A detailed account is given of the physico-chemical theory underlying the development of these new materials.

621.315.591.5† : 537.32 **2266**

Thermoelectric Power of Cadmium Oxide.—J. P. Andrews. (*Proc. phys. Soc.*, Nov. 1947, Vol. 59, No. 336, pp. 990–996. Discussion, pp. 996–998.) Discussion of measurements of the thermoelectric e.m.f. of the semiconductor CdO against Pt in the temperature range −110°C to 800°C.

621.315.616 : 621.317.3.011.5 **2267**

The Intrinsic Electric Strength of Polythene and Its Variation with Temperature.—W. G. Oakes. (*J. Instn elect. Engrs*, Part I, Jan. 1948, Vol. 95, No. 85, pp. 36–44.) A systematic investigation of all the factors affecting electric strength measurement, leading to the development of a method giving reliable results. The d.c. strength of polythene is substantially independent of specimen thickness up to 0.008 inch. At 25°C the value is about 17 MV/inch and changes only slightly down to −200°C. Above 25°C it falls steadily to about 2 MV/inch at the melting point (about 115°C). At power frequencies the a.c. strength decreases with increasing specimen thickness and time of application of voltage, and a.c. values are lower than d.c. values at corresponding temperatures. Possible explanations of the differences between a.c. and d.c. breakdown are suggested.

621.383 : 535.215.1 : 546.682 **2268**

The Photoelectric Properties of Sulphides and Selenides of Indium.—In 1388 of May please alter the first author's name to Kolomiets.

548 : 517.512.2 **2269**

Fourier Transforms and Structure Factors. [Book Review]—D. Wrinch. Asxred Monograph No. 2, 1946, 96 pp., $4.00. (*Proc. phys. Soc.*, Nov. 1947, Vol. 59, No. 336, pp. 1044–1045.) It is shown how the structure factor of a particular atomic grouping may be combined with those of other atomic groupings to determine the structure factor of a crystal as a whole. It is easier to work with the 'transform' of a distribution (the structure factor per effective electron) than with the structure factor itself.

MATHEMATICS

517.512.2 : 621.396.67 **2270**

Fourier Transforms in Aerial Theory: Part 5 — Fourier Approximation Curves.—J. F. Ramsay. (*Marconi Rev.*, Oct./Dec. 1947, Vol. 10, No. 87, pp. 157–165.) A study is made of a beam having a sharp and a blunt side. This asymmetrical pattern is partitioned into its even and odd components, each of which have Fourier approximations. The aperture excitations, in the form of 'mutilated' functions, are determined to provide these approximations. One aperture has a real even distribution, the other an imaginary (i.e. quadrature) odd distribution. These together provide the complex distribution necessary for the production of the asymmetrical pattern. The approximation pattern is also obtained without resorting to a partition by the use of the Dirichlet type of integral. A second example is concerned with the Fourier approximations to the 'lobe-less' Gaussian radiation pattern. Part 4, 1068 of April.

518.5 : 517.2/.3 **2271**

Errors of Electrical Differentiation and Integration Arrangements.—O. Heymann. (*Frequenz*, Jan. 1948, Vol. 2, No. 1, pp. 1–5.) Discussion of simple circuits comprising resistors and capacitors which can be used for differentiation or integration. The conditions under which such circuits give accurate results are determined. A short derivation of the Fourier integral law and of the Laplace-Riemann transformation is given in an appendix.

518.5 : 621.318.572 **2272**

High-Speed n-Scale Counters.—Sharpless. (*See* 2186.)

519.24 : 523.746.5 **2273**

New Statistical Method of Predicting Sunspots aids Radio Propagation Forecasts.—(*See* 2232.)

51(075) : 621.396 **2274**

Mathematics for Radio Engineers. [Book Review]—L. Mautner. Pitman Publishing Corp., New York, 1947, 327 pp., $5.00. (*Electronics*, March 1948, Vol. 21, No. 3, pp. 266, 268.) "Penetrates further into the subject than books intended for technicians, but is less extensive than engineering texts used in colleges." See also 162 of 1947 (Colebrook).

517.564.3 **2275**

Applied Bessel Functions. [Book Review]—F. E. Relton. Blackie & Son, London, 1947, 191 pp., 17s. 6d. (*Proc. phys. Soc.*, Nov. 1947, Vol. 59, No. 336, pp. 1047–1048.) A book intended for the new physics or engineering graduate. "For anyone anxious to know something about Bessel functions there are books as good as this, but few could claim to be better."

MEASUREMENTS AND TEST GEAR

531.764.5 **2276**

Crystal Clock for Accurate Time Signals.—V. E. Heaton. (*Instruments*, July 1947, Vol. 20, No. 7, pp. 618–619.) A brief description of the continuous time-signal service provided by the National Bureau of Standards.

621.3.018.41(083.74) + 621.317.76 **2277**

A Standard of Frequency and Its Applications.—C. F. Booth & F. J. M. Laver. (*J. Instn elect. Engrs*, Part III, Jan. 1948, Vol. 95, No. 33, p. 52.) Discussion on 2973 of 1946.

621.316.726 : 621.396.61 **2278**

Frequency Composition in Naval Communication Transmitters.—J. J. Hupert. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 12, pp. 405–417.) A crystal-controlled frequency is mixed with the much lower frequency of an accurately calibrated variable oscillator. By using a variable oscillator covering a fixed range and by changing the crystal frequency in steps, a wide range of accurate resultant frequencies can be obtained. A full theory is given of the spurious frequencies which are inevitably produced by this system, and of methods by which they can be reduced. Application to standard naval equipment is described.

621.317.2 : 621.397.62 **2279**

Television Receiver Laboratory.—F. R. Norton. (*Electronics*, March 1948, Vol. 21, No. 3, pp. 86–89.) Description of test facilities and equipment, including power supplies and filtering, and the construction of a shielded room.

621.317.3.011.5 : 621.315.616 **2280**

The Intrinsic Electric Strength of Polythene and Its Variation with Temperature.—Oakes. (*See* 2267.)

621.317.35 : 621.396.619.16 : 621.396.813 **2281**

PCM Distortion Analysis.—A. G. Clavier, P. F. Panter & D. D. Grieg. (*Elect. Engng, N.Y.*, Nov. 1947, Vol. 66, No. 11, pp. 1110–1112.) Long summary of A.I.E.E. paper. Information is transmitted by a coded pulse system. In the system analysed, the modulating signal is divided into 31 levels, a five-unit binary numbering system being used to identify each amplitude.

In order to calculate the distortion introduced when pulse code modulation is applied to a sine wave, the signal may be replaced by a step function. The application of pulse a.m. to this step function will give the same modulated waveform and degree of distortion.

Fourier transformations are used in order to analyse pulse code modulation of signals consisting of continuous frequency bands, and to compute distortion and crosstalk. See also 1161 of April and back references.

621.317.372 **2282**

Measurement of High-Q Cavities at 10 000 Mc/s.—R. W. Lange. (*Bell Syst. tech. Publ. Monogr.*, B-1474, 6 pp.) Known methods of measuring Q in resonant cavities together with their sources of error are discussed. For low values of Q and frequency, bandwidth methods are more accurate than decrement methods. For values of Q above 30 000 at frequencies above 3 000 Mc/s, the reverse is true. Design features and performance are discussed for wide-range heterodyne decrement apparatus in which the accuracy is improved by observing the decay over a relatively long interval.

621.317.7 + 621.38 + 621.396.69 **2283**

Physical Society's Exhibition.—(*Wireless Engr*, May 1948, Vol. 25, No. 296, pp. 157–162; *Wireless World*, May 1948, Vol. 54, No. 5, pp. 174–179.) Short descriptions of some of the exhibits.

621.317.725 **2284**

High-Frequency Crystal Voltmeter.—B. F. Tyson. (*Electronics*, March 1948, Vol. 21, No. 3, pp. 150..154.) A probe type of instrument using a 1N28 crystal rectifier. Construction and circuit details are given.

621.317.725 **2285**

An Inverted Tetrode Voltmeter for High Negative Voltages.—R. J. Schneeberger. (*Rev. sci. Instrum.*, Jan. 1948, Vol. 19, No. 1, pp. 40–42.) By interchanging the normal functions of the grid and anode of a conventional valve, large negative potentials applied to the anode can be measured as a function of grid current. A tetrode operated in this manner, in a circuit with a large amount of grid-cathode degeneration, makes possible an instrument possessing a high degree of stability and an input impedance of the order of $10^{13}\ \Omega$. A nearly linear scale extends from zero to -30 kV.

621.317.726.029.63 **2286**

The Measurement of Peak Voltage at a Frequency of 600 Mc/s by means of a Modified Probe Circuit.—G. W. Bowdler. (*J. Instn elect. Engrs*, Part III, Jan. 1948, Vol. 95, No. 33, pp. 25–30.) A cascade doubler circuit using two Si-crystal rectifiers and a galvanometer enables peak voltage to be measured, given the pulse repetition rate and waveform. When a tuned stub was used to compensate for the stray capacitance shunting the rectifiers, measurements were found to agree with values deduced from calorimetric methods.

621.317.729 **2287**

An Electric Field Meter for Use on Airplanes.—R. C. Waddel. (*Rev. sci. Instrum.*, Jan. 1948, Vol. 19, No. 1, pp. 31–35.) An instrument for measuring the magnitude and polarity of electric fields encountered in flight. A control box, containing the amplifier, range switch and voltmeter, is connected by a cable to a measuring head mounted on the surface of the selected part of the aircraft. Power is derived from the aircraft's 28-V d.c. supply. The range 5–4 000 V/cm is covered in four steps with linear scales.

621.317.733 **2288**

A.C. Bridges.—" Cathode Ray ". (*Wireless World*, April 1948, Vol. 54, No. 4, pp. 139–142.) A simple explanation, in terms of vectors, of basic principles.

621.317.738 **2289**

Capacitance Meter with Quartz [resonance] **Indicator.**—P. G. Bordoni & D. Sette. (*Ricerca sci.*, July/Aug. 1947, Vol. 17, Nos. 7/8, pp. 1122–1127.) Long summary. Essentially a substitution method, the unknown capacitance C_x being measured by the difference in the resonance readings of a standard capacitor without and with C_x in parallel. Full paper in *Elettronica*, 1947, Vol. 2, pp. 171ff.

621.317.755 : 621.396.61.001.4 **2290**

Uses of the Cathode-Ray Oscillograph in Transmitter Adjustment and Control.—S. H. Coombs. (*Oscillographer*, May/June 1946, Vol. 8, No. 3, pp. 1–11.) Oscillographic patterns which can be used for transmitter adjustment are : (*a*) audio sine-wave, for testing the a.f. channel, (*b*) r.f. unmodulated wave pattern, for adjusting the r.f. channel, (*c*) Lissajous pattern, for neutralization indication and adjustment of frequency multiplier stages, (*d*) modulated-wave pattern, for checking over-all performance and indicating sources of trouble, and (*e*) trapezoidal pattern, for monitoring modulation and checking performance. The theory of these patterns, circuits for producing them on the c.r.o., and typical oscillograms due to common faults are discussed in detail. The Du Mont Type 213A modulation monitor is also briefly described.

621.317.76 : 621.396.619.13 **2291**

F.M. Monitor has Pulse-Counter Discriminator.—C. A. Cady. (*F.M. & Televis.*, Dec. 1947, Vol. 7, No. 12, pp. 18–21, 36.) Detailed description and circuit diagrams of a new General Radio frequency monitor for broadcasting and television sound transmitters, which gives continuous indications of the centre-frequency deviation, modulation percentage and over-modulation peaks. An input of only 1 V into a high impedance is required.

621.317.761.029.4/.54 **2292**

A Direct-Reading Frequency Meter for the Audio and Supersonic Ranges.—H. J. Reich & R. L. Ungvary. (*Rev. sci. Instrum.*, Jan. 1948, Vol. 19, No. 1, pp. 43–46.) An electronic meter operating in the range 20 c/s to 200 kc/s. The accuracy of the instrument is determined by the accuracy of the indicating meter ; the reading is independent of waveform as long as the input wave does not cross the zero axis more than twice in its fundamental period. With a sinusoidal input, the voltage required for reliable operation is less than 0.03 V r.m.s. between the frequencies 900 c/s and 200 kc/s.

621.317.763 **2293**

Direct-Reading Wavemeter Design.—G. E. Feiker & H. R. Meahl. (*Electronics*, March 1948, Vol. 21, No. 3, pp. 103–107.) Construction details of wavemeters for the range 2 to 75 cm (15 000 to 400 Mc/s) are given. These precision wavemeters are suitable for field service. Comparison is made with some British developments. The theory involved in obtaining a linear law is given for cavity devices of the finger-contact and re-entrant line short-circuit types.

621.317.79 : 551.510.535 **2294**

High-Power Ionosphere-Measuring Equipment.—P. G. Sulzer. (*Proc. Inst. Radio Engrs, W. & E.*, March 1948, Vol. 36, No. 3, pp. 389–394.) The transmitter has a peak power output of 100 kW from 1 to 8 Mc/s, decreasing to 50 kW at 16 Mc/s. It gives pulses of duration 20–200 μs. Special features are described of a transformer which reverses the polarity of a 9-kV square-topped negative pulse and provides various output voltages up to 14 kV. The receiver is a Hammarlund Super-Pro, modified for pulse reception. Typical results obtained with the equipment are illustrated.

621.317.79 : 621.315.2 **2295**

Pulse Echo Measurements on Telephone and Television Facilities.—L. G. Abraham, A. W. Lebert, J. B. Maggio & J. T. Schott. (*Bell Syst. tech. Publ. Monogr.*, B-1469, 8 pp.) A full description of two equipments. One is an improved pulse echo set for testing coaxial cables, with pulse rates of 56, 13 or 3.3 kc/s and pulse widths of 0.25 or 1.5 μs. The other is a device called the ' Lookator ', built to locate faults in spiral-four field cables and open-wire lines. A pulse repetition rate of 220 c/s is used and the echo time can be measured to within about 5 μs. See also 429 of 1946 (Schott).

621.317.79 : [621.396.615 + 621.396.619 **2296**

Instrument for Intermodulation Measurements.—G. Daniel. (*Electronics*, March 1948, Vol. 21, No. 3, pp. 134 . . 150.) A signal generator in which two independent frequencies are produced and combined, and an analyser in which the degree of modulation of the higher frequency by the lower is determined. A detailed circuit diagram is given.

621.317.79 : 621.396.615 **2297**

A New A.M.-F.M. Signal Generator.—J. Najork. (*Radio News*, Feb. 1948, Vol. 39, No. 2, pp. 49–51 . . 114.) Complete circuit details are given of a portable instrument for the alignment of a.m. and f.m. receivers. The r.f. oscillator has a range from 100 kc/s to 150 Mc/s. The f.m. oscillator has centre frequencies of 1, 20 and 50 Mc/s, with maximum frequency deviations of ± 20, ± 300 and ± 700 kc/s respectively. In addition there is a variable frequency audio oscillator, and a 1-Mc/s crystal calibrator.

621.317.79 : 621.396.621.54.001.4 **2298**

The Testing of Communication-Type Radio Receivers.—W. J. Bray & W. R. H. Lowry. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 12, pp. 313–327.) Standard tests and equipment for determining the performance of superheterodyne receivers in the frequency range 30 kc/s–30 Mc/s are described. R.f. sensitivity, a.f. linearity and distortion measurements, the determination of the noise factor, cross modulation, blocking characteristics, and the performance of a.f.c. and a.g.c. systems are considered. The characteristics of a typical receiver are given to explain the method of presentation of the results.

621.317.79 : 621.396.812.3 **2299**

The Fading Machine, and Its Use for the Investigation of the Effects of Frequency-Selective Fading.—W. J. Bray, H. G. Lillicrap & F. C. Owen. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 12, pp. 283–297.) An equipment to simulate the frequency-selective fading characteristics of long-distance s.w. radio channels. Three transmission paths are incorporated; the group time-delay differences between these may be varied in steps from 0 to 2 ms. The phase differences between the paths may be varied manually or continuously at rates ranging from 0.1 to 10 fades/sec. Random noise may be included so as to synthesize a complete s.w. channel. The equipment may also be used to simulate diversity reception.

Examples are given of the use of the equipment to assess the relative merits of double-sideband, single-sideband, and f.m. transmission systems with telephony or telegraphy modulation, under conditions of severe selective fading and high noise level.

621.317.79.029.58 **2300**

Standing-Wave Indicator for 3-22 Mc/s.—W. N. Baker. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 12, pp. 328–330.) A midget diode rectifies the r.f. current induced in a shielded loop coupled to the feeder lines. An adjustable portion of the d.c. voltage from the diode is fed through 100 ft of cable to a d.c. amplifier operating a milliammeter. The equipment is self-contained, battery-operated, and more robust than thermocouple or rectifier and microammeter types of instrument.

621.396.615.17 **2301**

A Portable Pulse Generator.—E. W. Titterton & V. L. Fitch. (*Rev. sci. Instrum.*, Sept. 1947, Vol. 18, No. 9, pp. 639–643.) The generator provides either negative or positive rectangular pulses from a low-impedance source. The amplitude is variable from zero to 75 V at recurrence frequencies of 1–10 000 c/s. The circuit may also be driven from an external signal generator.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

531.717.1 : 621.386 **2302**

X-Ray Thickness Gage.—(*Electronics*, March 1948, Vol. 21, No. 3, pp. 154..168.)

533.15 : 537.534 **2303**

Electronics simulates Sense of Smell.—W. C. White & J. J. Hickey. (*Electronics*, March 1948, Vol. 21, No. 3, pp. 100–102.) The presence of halogen vapour compounds, such as freon or CCl_4, increases the positive-ion emission from an incandescent Pt wire in air. This effect is used in a simple and readily portable leak detector.

534.321.9.001.8 **2304**

Coupling Ultrasonic Energy to a Load.—S. Y. White. (*Audio Engng, N.Y.*, March 1948, Vol. 32, No. 3, pp. 29-31..43.) Discussion of problems involved in the practical application of ultrasonics.

537.531 : 620.179.1 **2305**

The Detection of Cracks by X-Rays and Gamma Rays.—C. Croxson. (*Electronic Engng*, April 1948, Vol. 20, No. 242, pp. 106–111.)

539.16.08 **2306**

Scale-of-Hundred Counting Unit.—J. Rotblat, E. A. Sayle & D. G. A. Thomas. (*J. sci. Instrum.*, Feb. 1948, Vol. 25, No. 2, pp. 33–37.) Two electronic scale-of-ten units, each having a resolving time of 3 μs, are followed by a mechanical counter; rates up to 1 000 impulses/sec can thus be recorded from counters or ionization chambers. Each scale-of-ten unit consists of four scale-of-two units, the first three of which are standard. The fourth is modified so that it is triggered normally by the eighth pulse and then couples the first and second scale-of-two units until restored to its initial state by the tenth pulse.

539.16.08 **2307**

A Direct-Reading Indicator for Electronic Counters.—G. T. Baker. (*Electronic Engng*, April 1948, Vol. 20, No. 242, pp. 112–113.) Uses 4 scale-of-2 circuits, with a small c.r. tube provided with a digit scale from 0 to 9. The working of the indicator is explained in detail.

539.16.08 **2308**

Some Discharge Characteristics of Geiger-Müller Counters.—H. V. Neher. (*Phys. Rev.*, 1st March 1948, Vol. 73, No. 5, p. 533.) Summary of Amer. Phys. Soc. paper.

539.16.08 : 621.386 **2309**

Recovery Time of Geiger Counters for X-Ray Intensity Measurement.—R. Pepinsky, P. Jarmotz, H. M. Long & D. Sayre. (*Rev. sci. Instrum.*, Jan. 1948, Vol. 19, No. 1, pp. 51–52.) The response of a G-M counter to double bursts of X rays is displayed on a c.r.o. synchronized to the repetition rate of the double bursts. The time interval between the initial and the second burst of any pair can be varied from zero to 500 μs and both are observable on the c.r.o. as long as the second burst does not occur within the dead time of the counter.

621.317.39 : 620.178.3 **2310**

Airborne Engine Analyzer.—V. C. Cetrone. (*Electronics*, March 1948, Vol. 21, No. 3, pp. 90–95.) An electronic instrument for fault finding in aircraft engines is described. Diagrams are given of circuits which provide a c.r. display of ignition and vibration patterns regardless of engine speed. Typical ignition patterns for normal conditions, a fouled plug, an open secondary, and magneto-point bounce, and the vibration pattern of a normal cylinder, are illustrated.

621.319.339 **2311**

The Berkeley Four Million Volt Electrostatic Generator.—C. Turner, B. Cork, J. Ballam & H. Gordon. (*Phys. Rev.*, 1st March 1948, Vol. 73, No. 5, p. 534.) Summary of Amer. Phys. Soc. paper.

621.319.339 **2312**

Ion Source Equipment for Berkeley Electrostatic Generator.—F. Fillmore, A. Hudgins & M. Jeppson. (*Phys. Rev.*, 1st March 1948, Vol. 73, No. 5, p. 534.) Summary of Amer. Phys. Soc. paper.

621.38.001.8 **2313**

Industrial Electronic Apparatus.—D. W. Thomasson. (*Wireless World*, March 1948, Vol. 54, No. 3, pp. 88–91.) Discussion of design, stressing the importance of simple and robust construction, accessibility of components, and standardization of units.

621.384.6 **2314**

Development of the Frequency Modulated Cyclotron.—J. R. Richardson, B. T. Wright, E. J. Lofgren & B. Peters. (*Phys. Rev.*, 1st March 1948, Vol. 73, No. 5, pp. 424–436.) A theoretical and experimental investigation of some fundamental characteristics of the cyclotron, including the variation of ion current with modulation frequency, time of flight of ions and beam focusing. Ion currents were measured by a probe method.

621.384.6 **2315**

Unidirectional Pulse Operation of a 22-MeV Betatron.—H. W. Koch & C. S. Robinson. (*Rev. sci. Instrum.*, Jan. 1948, Vol. 19, No. 1, pp. 36–39.) Description of the circuit used. Minor changes are necessary in the methods of electron injection and orbit expansion used with continuous excitation.

621.384.6 **2316**

Physical Design of the Berkeley Linear Accelerator.—H. Bradner, R. Crawford, H. Gordon & J. R. Woodyard. (*Phys. Rev.*, 1st March 1948, Vol. 73, No. 5, pp. 534–535.) Summary of Amer. Phys. Soc. paper.

621.384.6 **2317**

Beam Dynamics in the Linear Accelerator.—R. Serber. (*Phys. Rev.*, 1st March 1948, Vol. 73, No. 5, p. 535.) Summary of Amer. Phys. Soc. paper.

621.384.6 **2318**

Linear Accelerator Oscillator and Coupling System.—W. R. Baker, J. V. Franck & J. D. Gow. (*Phys. Rev.*, 1st March 1948, Vol. 73, No. 5, p. 535.) Summary of Amer. Phys. Soc. paper.

621.384.6 **2319**

Control of the Field Distribution in the Linear Accelerator Cavity.—W. K. H. Panofsky, C. Richman & F. Oppenheimer. (*Phys. Rev.*, 1st March 1948, Vol. 73, No. 5, p. 535.) Summary of Amer. Phys. Soc. paper.

621.384.6 : 621.3.011.4 : 537.52 **2320**

Use of Plasma Sheaths as Variable Capacitances.—W. E. Parkins & J. M. Leffler. (*Phys. Rev.*, 1st March 1948, Vol. 73, No. 5, p. 538.) Summary of Amer. Phys. Soc. paper. A current-receiving electrode in a gas discharge has a capacitance which depends on the operating conditions, and specifically on the applied frequency. This capacitance variation may be useful in controlling the frequency of a f.m. cyclotron.

621.385.833 **2321**

Numerical Computation of the Constants of Magnetic Electron Lenses.—M.v. Ments & J. B. Le Poole. (*Appl. sci. Res.*, 1947, Vol. B1, No. 1, pp. 3–17.) The paraxial quantities are computed using special methods of integration and field measurement. Spherical aberration constants are calculated in a number of cases. The distortion of projector lenses is determined experimentally. Graphs of practical results which have proved helpful in design are given.

621.385.833 **2322**

A New Experimental Electron Microscope.—G. Liebmann. (*J. sci. Instrum.*, Feb. 1948, Vol. 25, No. 2, pp. 37–43.) The design of the specimen stage enables the vacuum to be restored to its working value 15 seconds after the specimen is changed. The lens coil currents may be varied to give a range of magnification from 100 to 13 500. By removing certain lens units the instrument may be used for electron diffraction.

621.385.833 : 535.317.25 **2323**

The Limiting Resolving Power of the [magnetic] **Electron Microscope.**—G. Liebmann. (*Phil. Mag.*, Oct. 1946, Vol. 37, No. 273, pp. 677–685.) Resolving power is limited by saturation in the e.m. lens. Combining theoretical work by Ramberg (2198 of 1943) with measurements undertaken by the author, "an estimate is obtained of the expected limit of resolving power that may be achieved in electron microscopes of the present type. This limiting resolving power has a slightly marked optimum for an accelerating voltage of 50 kV, and is of the order of 10 to 12 Å."

621.398 : [623.746.48 + 623.451 **2324**

Guided Missiles.—C. E. Chapel. (*Radio News*, Jan. 1948, Vol. 39, No. 1, pp. 39–41 . . 126.) Descriptions of a wide range of American guided missiles and pilotless aircraft, electronically controlled.

664.8 : 621.319.44 **2325**

Electronic Preservation of Food.—W. Huber. (*Electronics*, March 1948, Vol. 21, No. 3, pp. 74–79.) Foods of many kinds can be preserved for long periods by exposing them in their sealed containers to short pulses of cathode rays from a capacitron with a peak voltage of 3 MV. Similar treatment serves to sterilize drugs.

PROPAGATION OF WAVES

538.566.029.63 : 535.42 **2326**

Diffraction of Electromagnetic Waves.—W. O. Tranter. (*Phys. Rev.*, 15th Jan. 1948, Vol. 73, No. 2, p. 184.) Comparison of results obtained by Andrews (*ibid.*, 1947, Vol. 71, p. 777) for an e.m. wave that has passed through a circular aperture, with results for two vertical unactivated dipoles. The dipoles were supported by thin glass rods and separated in the H plane by successive distances λ, 2λ and 3λ. Reradiation from the sides of the aperture must be considered in the diffraction of e.m. waves. See also 3717 of 1946.

621.396 : 551.5 **2327**

Meteorology and Radio.—Perlat. (*See* 2236.)

621.396.11.029.62 : 551.510.535 : 523.5 **2328**

Reflections of Very-High-Frequency Radio Waves from Meteoric Ionization.—E. W. Allen, Jr. (*Proc. Inst. Radio Engrs, W. & E.*, March 1948, Vol. 36, No. 3, pp. 346–352.) Continuous recordings of field strengths of long-distance transmissions in the 42–84-Mc/s band reveal short 'bursts' of varying intensity, which may be due to reflections from ionization in the upper atmosphere caused by meteor trails. The correlation between distributions of the bursts and theoretical and observed distributions of meteors is shown.

621.396.11.029.64 **2329**

Low-Level Atmospheric Ducts.—J. S. McPetrie & B. J. Starnecki. (*Proc. Inst. Radio Engrs, W. & E.*, March 1948, Vol. 36, No. 3, p. 363.) Field strength measurements for λ 3 cm and 9 cm over a 60-mile sea path in the Irish Channel showed good agreement with theoretical results when low-level atmospheric ducts were assumed present for about 70% of the time. Later analysis of meteorological results proved the assumption correct, thus partly supporting the results reported in 521 of February (Katzin, Bauchman & Binnian). It was not found, however, that high winds are associated with higher ducts, nor was there any critical difference between the propagation of 3-cm and 9-cm waves. See also 518 of 1947 (Megaw).

621.396.11.029.64 : 551.509.39 **2330**

Over-Water Microwave-Propagation Forecasting.—J. R. Gerhardt & W. E. Gordon. (*Bull. Amer. met. Soc.*, March 1947, Vol. 28, No. 3, pp. 126–136.) The effect of weather on microwave propagation is briefly discussed and a method of forecasting radar ranges is developed. Results based on meteorological soundings of the atmosphere over Massachusetts Bay in the summer of 1944 indicate that the method can provide reasonably accurate forecasts of maximum radar ranges up to 24 hours in advance.

621.396.812.029.64 **2331**

Experimental Studies of the Propagation of Very Short Radio Waves.—E. C. S. Megaw. (*J. Instn elect. Engrs*, Part III, Jan. 1948, Vol. 95, No. 33, pp. 51–52.) Discussion on 518 of 1947.

621.396.812.029.64 : 551.578.1 **2332**

Rainfall Intensities and Attenuation of Centimeter Electromagnetic Waves.—R. Wexler & J. Weinstein. (*Proc. Inst. Radio Engrs, W. & E.*, March 1948, Vol. 36, No. 3, pp. 353–355.) Analysis of rainfall intensities and radar coverage at four selected stations in the U.S.A. indicates that the use of high-power 3-cm radar for storm detection is not seriously limited by attenuation due to rain.

621.396.812.3 : 621.317.79 **2333**

The Fading Machine, and Its Use for the Investigation of the Effects of Frequency-Selective Fading.—Bray, Lillicrap & Owen. (*See* 2299.)

RECEPTION

621.396.61/.62 **2334**

The Design of Transmitter Drives and Receivers for Single-Sideband Systems.—Bray, Lillicrap & Lowry. (*See* 2395.)

621.396.621 **2335**

The Receiver R.C.A. AR-88D.—P. A. Boursault. (*T.S.F. pour Tous*, Dec. 1947, Vol. 23, No. 230, pp. 267–273.) Complete circuit details, description and performance. The frequency range from 535 kc/s to 32 Mc/s is covered in 5 bands.

621.396.621 **2336**

A High-Fidelity Receiver.—L. Chrétien. (*T.S.F. pour Tous*, Dec. 1947, Vol. 23, No. 230, pp. 258–261 & Jan.–March 1948, Vol. 24, Nos. 231–233, pp. 3–5, 35–36 & 61–64.) The first four of a series of articles on a receiver suitable for feeding the high-fidelity amplifier previously described (1047 of 1947). The advantages and disadvantages of a h.f. stage are discussed fully.

621.396.621 **2337**

This Radio services Itself.—R. Brenta. (*Radio Craft*, Dec. 1947, Vol. 19, No. 3, pp. 26–27.) To avoid the trouble and inconvenience involved in servicing the standard type of receiver, the 'Cosmo Compo' receiver is designed so that each major stage of the circuit — oscillator, r.f. amplifiers, i.f. amplifiers, etc.—is contained in a separate can which is plugged into the chassis. There are no components fixed directly to the chassis and the only wiring is that connecting the various plug points. When a fault develops the faulty unit is removed and a sound one substituted.

621.396.621 **2338**

Ekco Model A52.—(*Wireless World*, March 1948, Vol. 54, No. 3, pp. 94–96.) Test report of a 5-valve superheterodyne for a.c. supply, with rotary programme-selector switch, three-position tone control, and band-spread tuning on short waves. Wave ranges are 11–14 m, 16–20 m, 24–50 m, 200–550 m and 1 000–2 000 m.

621.396.621 **2339**

The FreModyne F.M. Detector.—(*Radio News*, Feb. 1948, Vol. 39, No. 2, pp. 48, 156.) A double triode is used in this inexpensive unit which can be added to an existing a.m. receiver for f.m. reception. One triode is used as a superheterodyne oscillator; the other acts as a superheterodyne converter, a superregenerative i.f. amplifier, a f.m./a.m. converter and an a.f. detector. See also 1731 of June and 2065 of July (A. A. McK.).

621.396.621 : 621.396.619.11 **2340**

The Synchrodyne.—E. Langberg. (*Electronic Engng*, April 1948, Vol. 20, No. 242, p. 132.) A short account of the application of the synchrodyne principle to the construction of a communication receiver. See also 1139 of April and back references.

621.396.621.029.63 : 621.396.931 **2341**

Receiver for the Citizens Radio Service: Part 2.—W. C. Hollis. (*Electronics*, March 1948, Vol. 21, No. 3, pp. 80–85.) Circuit operation and construction details for a 465-Mc/s superheterodyne receiver for operation in conjunction with the transmitter noted in 855 of March. The i.f. is 15 Mc/s and bandwidth 250 kc/s. The measured noise figure is 20 db above the theoretical value. This small portable unit has grounded-grid input, cavity resonators, and crystals in limiter and discriminator.

621.396.621.54 : 621.396.611.21 **2342**

Few Crystals control Many Channels.—W. R. Hedeman, Jr. (*Electronics*, March 1948, Vol. 21, No. 3, pp. 118–121.) The local oscillator of a multichannel superheterodyne receiver for aircraft communication is controlled on 120 channels by only 10 crystals. Conditions for minimum number of crystals, frequency spacing, and stability are discussed.

621.396.622 : 621.396.619.13 **2343**

Concerning the Detection of F.M. Waves.—E. Labin. (*Onde élect.*, Feb. 1948, Vol. 28, No. 251, pp. 60–69.) The output signal is calculated for a f.m. detection system when the incident wave has both f.m. and a.m. According to some views the output signal should only depend slightly, or not at all, on the a.m. of the input signal, since the detector system is of the differential type. Discussion shows that this idea is not well founded, though the symmetrical detector may give a higher signal/noise ratio and improve the linearity of the characteristic.

621.396.622.7 **2344**

An Answer to N.F.M. Reception.—L. H. Allen. (*QST*, Feb. 1948, Vol. 32, No. 2, pp. 28–29.) Discusses the advantages of the ratio detector as a simple means of providing either a.m. or f.m. reception and gives the modifications necessary for alternative reception on a communication receiver.

621.396.622.7 **2345**

F.M. Reception: Comparison Tests between Phase Discriminator and Ratio Detectors.—D. Maurice & R. J. H. Slaughter. (*Wireless World*, March 1948, Vol. 54, No. 3, pp. 103–106.) The ratio detector is about 2 db noisier except for very small signals, with no appreciable difference in quality of reproduction for a given input signal. The relative merits of the two systems are discussed.

621.396.622.71 **2346**

Ratio Detectors for F.M. Receivers.—S. W. Seeley. (*F.M. & Televis.*, Dec. 1947, Vol. 7, No. 12, pp. 26–27 . . 47.) Principles and performance characteristics. See also 3643 of 1947 (Seeley & Avins), 248 of January and 1476 of May (Hayes).

621.396.662 **2347**

The C.A.P. F.M.-A.M. Tuner.—W. H. Collins. (*F.M. & Televis.*, Nov. 1947, Vol. 7, No. 11, pp. 18–20.) The f.m. section, operating at 88–108 Mc/s, comprises an Armstrong circuit followed by 3 i.f. stages, a cascade resistance-coupled limiter and a duo-diode discriminator. The a.m. section consists of 2 r.f. band-pass stages, a buffer stage and a duo-diode detector. The output of either section can be switched into an a.f. triode amplifier.

621.396.82 **2348**

Mutual Radio Interference in H.M. Ships.—C. Matthews & R. L. A. Borrow. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 12, pp. 418–426.) The principles involved in avoiding mutual interference which were enforced before 1939 could not be maintained during the war, because of the necessity of fitting commercial equipment, and especially with the coming of radar. Radar equipment constituted the main source of interference in communication reception, though insufficiently screened receivers and spurious frequencies in transmitters decreased efficient reception. Radio interference suppression units, which muted the receiver during the transmission of each radar pulse, were fitted to reduce interference when the offending equipment could not be modified. By using receiving aerial filters and limiter circuits, interference was further reduced. A code of practice has been formulated for the installation of equipment so as to reduce interference as much as possible.

621.396.822 **2349**

Measurements of ' Inherent ' Noise in Radio Receivers.—M. K. Dasgupta, J. Ray & S. R. Khastgir. (*Indian J. Phys.*, Oct. 1947, Vol. 21, No. 5, pp. 239–258.) The inherent noise was measured in terms of the equivalent noise voltage at the input of the receiver. Measurements were made on 6 a.c./d.c. commercial receivers at frequencies between 1 Mc/s and 20 Mc/s and for carrier voltages from 0.02 μV to 1 mV. The equivalent noise voltages were found to be about 1 μV for a carrier input of 1 μV, and except for m.f. channels, there was a linear relation between input and output up to a certain level. Above this level, there was an increase in noise level due to a.v.c. action, and the rate of increase of equivalent noise voltage decreased. There was, in general, an increase in this voltage for higher frequency channels. Results for a receiver operated (*a*) from the mains, and (*b*) from batteries, show the effect of imperfect filtering of line noise.

621.396.822 **2350**

On a Non-Linear Noise Problem.—F. L. H. M. Stumpers. (*Philips Res. Rep.*, Aug. 1947, Vol. 2, No. 4, pp. 241–259.) Noise from a normal source is passed through a filter with a rectangular amplitude/frequency characteristic. The output is applied to a valve with a nonlinear characteristic. The resulting energy frequency spectrum is considered with special reference to the work of Fränz (3026 of 1941 and 443 of 1944). The partial spectra arising from multifolds of the original central frequency have different forms; they can be distinguished by their order. A formula is derived from which all partial spectra can be computed directly if the characteristic is given as a polynomial or power series. The effect of carrier waves is also considered.

621.396.822 : 621.396.813.015.33 **2351**

The Effect of Fluctuation Noise Interference on Pulse Distortion.—P. J. Hilton. (*Phil. Mag.*, Oct. 1946, Vol. 37, No. 273, pp. 685–693.) Theoretical discussion, resulting in a table which gives the probability that the total distortion will exceed the maximum distortion for the signal pulse alone, as a function of noise amplitude and r.m.s. voltage.

621.396.828 **2352**

Radiation from Receivers.—G. J. McDonald & D. A. Thorn. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 12, pp. 427–436.) " Details are given of the Statutory Rules and Orders which were promulgated to control the level of radiation permissible from ships' receivers, and the problem of developing a technique suitable for checking individual installations for compliance with the limits laid down in these regulations is discussed. Examples of practical testing installations are given together with details of new receiver designs and modifications to existing equipments which ensured a sufficiently low and safe level of radiation."

STATIONS AND COMMUNICATION SYSTEMS

621.391.64 : 621.327.44 **2353**

Modulation of the Resonance Lines in a Cesium Arc.—J. M. Frank, W. S. Huxford & W. R. Wilson. (*J. opt. Soc. Amer.*, Sept. 1947, Vol. 37, No. 9, pp. 718–725.) Full paper. Summary abstracted in 4023 of 1947.

621.394.441 **2354**

Carrier-Frequency-Shift Telegraphy.—R. Ruddlesden, E. Forster & Z. Jelonek. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 12, pp. 379–388.) The use of pulled-crystal and mixing-oscillator frequency-shift exciters is discussed. Pulled-crystal exciters, by virtue of their simplicity, are used primarily for mobile stations. Methods of detection, by band-pass filter selection or by a discriminator, are described. Practical advantages of frequency-shift operation are considered. The threshold value of the signal and of the time shift produced by random noise are analysed in an appendix. Although the discriminator method of detection has no theoretical advantage over keyed-carrier systems, in a typical example post-discriminator filtration gave a 14-db improvement and band-pass filter selection a 10-db improvement in threshold value.

621.395.44 : 621.315.052.63 : 621.316.9 **2355**

Power Line Treatment for the M1 Carrier Telephone System.—J. M. Dunham. (*Bell Lab. Rec.*, Jan. 1948, Vol. 26, No. 1, pp. 2–5.) Precautionary measures observed in carrier telephony over h.v. a.c. transmission lines are described, with details of some of the components used in such systems.

621.395.44 : 621.396.619.2 **2356**

A 48-Channel Carrier Telephone System.—G. H. Bast, D. Goedhart & J. F. Schouten. (*Philips tech. Rev.*, 1947, Vol. 9, No. 6, pp. 161–170.) Design considerations for a system using the available frequency range of 200 kc/s of existing multi-conductor cables in Holland. Each audio channel undergoes three successive modulations in such a way that narrow-band filters are needed only at low frequencies. The volume of the coils in these filters has been reduced to a fifth of its former value by using ' Ferroxcube ' (3155 of 1947).

621.396.1 **2357**

Atlantic City. Summary of the Findings of the International Telecommunication Conferences.—(*Wireless World*, April 1948, Vol. 54, No. 4, pp. 148–150.) For another account see 1749 of June (A.H.M.).

621.396.3 **2358**

Some Developments in Commercial Point-to-Point Radiotelegraphy.—J. A. Smale. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 12, pp. 345–367.) A survey of developments concerned chiefly with ensuring continuous communication on difficult circuits. Discussion of: (*a*) frequency shift keying, which is compared with on-off keying; (*b*) the introduction of relay stations in long difficult circuits such as London/Australia; (*c*) the use of ph.m. for s.w. transmitters on long-distance facsimile circuits; (*d*) the development of horizontal dipoles to augment vertical arrays; (*e*) wide-band coupling units for coaxial feeders to balanced aerials; (*f*) telegraph printing systems; (*g*) a variable-frequency f.m. system for the control of radio stations; (*h*) a high-speed photoelectric morse transmitter; (*i*) an electronic keying device.

621.396.41 : 621.385.832 **2359**

Pulse-Modulation Multiplex Communication System.—D. E. Manfredi. (*Elettronica*, Nov. 1947, Vol. 2, No. 9, pp. 335–338.) A system developed between 1935 and 1946 in Italy and very similar in principle to that described in 883 of March (Grieg, Glauber & Moskowitz). The commutator is a c.r. tube with a number of small anodes, arranged in line or in a circle, instead of a fluorescent screen. Each anode is connected to the suppressor grid of a valve whose first grid is controlled by the microphone current from one of the programmes. The electron beam scans each anode in turn, giving it momentarily the electric charge necessary to make the suppressor grid positive. Thus each valve in succession is open to the passage of a very short signal conveying a small fraction of the corresponding programme. The successive pulses are amplified and transmitted in order. At the receiving station another commutator tube, synchronized with the first, separates the signals, distributing them, via the appropriate anode, to the separate channels.

621.396.61/.62 **2360**

The Admiralty Type 612 Transportable Radio Equipment.—D. Hamilton. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 12, pp. 401–404.) The equipment is of robust unit construction, is watertight and floats in water. Designed primarily as a large transportable outfit, it is also used in ships as an emergency transmitter/receiver for the 1.5–13-Mc/s band. An additional receiver for use in 4 bands from 15 to 500 kc/s is included. The circuit design follows conventional practice, but the high stability oscillators and frequency-setting facilities are of interest.

621.396.61/.62 **2361**

152- to 162-Mc/s Mobile Equipment.—B. J. Cosman. (*F. M. & Televis.*, Nov. 1947, Vol. 7, No. 11, pp. 36–40.) A detailed description and circuits of emergency equipment. The transmitter unit is a crystal-controlled ph. m. type with an output of 25–30 W. The receiver unit uses miniature valves in 2 r.f. stages, a van der Bijl detector mixer, 4 i.f. stages at 5.3 Mc/s followed by a Foster-Seeley discriminator using crystal rectifiers, and an a.f. amplifier with an output of about 1 W.

621.396.619.15 **2362**

Frequency Shift Telegraphy — Radio and Wire Applications.—J. R. Davey & A. L. Matte. (*Bell Syst. tech. Publ. Monogr.*, B-1490, 15 pp.) Comparison is made with a.m. methods. Bandwidth problems, demodulation, noise effects, signal-level variation and frequency instability are considered. The outstanding characteristic of the frequency-shift method is its ability to accept large and rapid changes in signal amplitude. The signal/noise ratio is considerably higher than with a.m. telegraphy. Diversity reception, multipath propagation and the use of superimposed ph. m. for reducing the effects of fading, are also discussed.

621.396.619.16 **2363**

PCM Equipment.—H. S. Black & J. O. Edson. (*Elect. Engng, N.Y.*, Nov. 1947, Vol. 66, No. 11, pp. 1123–1125.) Long summary of A.I.E.E. paper. The advantages of pulse code modulation include: (*a*) ease of multiplex operation; (*b*) nonlinearity does not introduce crosstalk; (*c*) high signal/noise ratios are attainable; (*d*) flexibility of transmission standards. The modulation process is based on the principles of sampling and quantizing. The sampled and filtered a.m. voice signal pulses are first converted to length-modulated pulses and finally to pulse-code-modulated signals. See also 1161 of April and back references.

621.396.619.16 : 621.317.35 : 621.396.813 **2364**

P.C.M. Distortion Analysis.—Clavier, Panter & Grieg. (*See* 2281.)

621.396.619.16 : 621.385.1 **2365**

Electron Beam Deflection Tube for Pulse Code Modulation.—Sears. (*See* 2411.)

621.396.619.16 : 621.395.43 **2366**

An Experimental Multichannel Pulse Code Modulation System of Toll Quality.—L. A. Meacham & E. Peterson. (*Bell Syst. tech. J.*, Jan. 1948, Vol. 27, No. 1, pp. 1–43.) A full account of an experimental 24-channel multiplex system in which coding is effected by means of a new electron-beam tube (2411 below) and decoding by pulse excitation of a reactive network. Functional problems are discussed in general terms, and the complete experimental layout and some novel circuit techniques are described. Good speech quality is obtained. See also 545 of February (Goodall).

621.396.65 **2367**

Some Studies on Emergency Mine Communications.—E. J. Coggeshall, E. W. Felegy & L. H. Harrison. (*United States Bureau of Mines*, Report R.I. 4135, Jan. 1948, 44 pp.) Experiments on the transmission of signals at a.f. and r.f. from various locations in a mine to the surface are described. A.f. tests were conducted with telephone, ground-telegraphy and voice-amplification systems, and in the r.f. range v.h.f. 'walkie-talkie' and l.f. 33–120-kc/s systems were used. Except in the case of the v.h.f. system, which had an aerial, the transmitter and receiver were connected either to ground or to the track rails. Communication was practicable only by conduction currents and the optimum frequency depended on the type of conductor used. With ground conduction this frequency was above 120 kc/s but probably below 500 kc/s; with metallic conduction it was between 40 kc/s and 90 kc/s.

621.396.65 **2368**

Multi-Channel Communication System.—(*Wireless World*, March 1948, Vol. 54, No. 3, p. 93.) Details of a v.h.f. wide-band f.m. link, for use in conjunction with the projected oil pipe line from the Persian Gulf to the Mediterranean. The link will provide seven voice-frequency channels in each direction.

621.396.65 **2369**

Railway Communications for the Royal Tour.—M. W. Manson. (*Trans. S. Afr. Inst. elect. Engrs*, Nov. 1947, Vol. 38, Part 11, pp. 305–342. Discussion, pp. 343–348.) A full description of the communication and other equipment installed on the royal and pilot trains, with details of the results achieved in long-distance communication. A v.h.f. f.m. R/T link operated between the trains; long-distance communication was maintained by means of a 500-W transmitter fitted in the pilot train and operating on any one of 5 frequencies in the range 4–12 Mc/s.

621.396.65.029.64 : 621.397.743 **2370**

F.M. Relay out-performs Coax for Television.—M. B. Sleeper. (*F.M. & Televis.*, Dec. 1947, Vol. 7, No. 12, pp. 15–17, 35.) Discussion of the results of a comparison of video and a.f. modulated radio relay signals from Boston to New York with signals by coaxial cable from Washington. The f.m. radio relay gave definitely superior picture quality. See also 1755 of June (Durkee) and 1756 of June.

621.396.712 : 621.396.61 **2371**

The Radio Transmitting Station at Criggion.—W. West, A. Cook, L. L. Hall & H. E. Sturgess. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 12, pp. 269–282.) The station has a long-wave transmitter which is essentially similar to the GBR transmitter at Rugby, two l.f. transmitters and fourteen h.f. transmitters. The construction of the station and the events leading to its establishment are discussed. Various units of the internal and external plant are described, with special reference to a recently developed single-sideband transmitter, power and water supplies, and line-termination equipment.

SUBSIDIARY APPARATUS

621.314.65 **2372**

The Steel Bulb Mercury Arc Rectifier.—H. J. H. Nethersole & L. L. Brinkworth. (*Trans. S. Afr. Inst. elect. Engrs*, Dec. 1947, Vol. 38, Part 12, pp. 351–364. Discussion, pp. 365–369.) Theory, construction, methods of ignition and excitation, and applications of various types of such rectifiers are discussed, with particular reference to the evolution of the steel-bulb type, its properties and its advantages over earlier types.

621.315.66 : 621.396.65.029.64 **2373**

Portable Microwave Tower.—(*Bell Lab. Rec.*, Jan. 1948, Vol. 26, No. 1, pp. 6–8.) The sectionalized tower may be erected quickly and safely without the assistance of professional riggers. Assembly and erection are carried out by progressively raising the tower in an erection frame and inserting further sections at the base. A height of 200 ft may be attained.

621.318.5 **2374**

Mercury Contact Relays.—J. T. L. Brown & C. E. Pollard. (*Elect. Engng, N.Y.*, Nov. 1947, Vol. 66, No. 11, pp. 1106–1109.) Long summary of paper presented at the National Electronics Conference. Metal contacts are kept wetted with mercury by means of a capillary connection to a reservoir in the base of the relay. The light-weight armature supporting the capillary also carries the moving contacts. See also 562 of February (McCormick).

621.318.5 : 621.315.212 **2375**

Glass-Enclosed Reed Relay.—W. B. Ellwood. (*Elect. Engng, N.Y.*, Nov. 1947, Vol. 66, No. 11, pp. 1104–1106.) Long summary of paper presented at the National Electronics Conference. A high-speed compact relay, one form of which can be used inside coaxial cables. The relay comprises a coil and a magnetically operated switch. The switch is used as the core of the coil which provides the operating magnetomotive force. Terminals are provided for the switch and coil on an octal base. Design and performance are fully discussed. See also 1583 of 1946 (Ellwood) and 562 of February (McCormick).

621.318.572 **2376**

Electronic Switching for the Ham Antenna.—T. Gootée. (*Radio News*, Jan. 1948, Vol. 39, No. 1, pp. 50–51 . . 116.) Government surplus stocks of t.r. radar valves are available and may be used without modification for automatic transmit-receive switching of amateur installations. Circuits and operational details are given.

621.396.68 : 621.397.6 **2377**

Television E.H.T. Supply : Parts 1 & 2.—Walker. (*See* 2390.)

621.396.681 **2378**

Emergency Supply Systems with Accumulator Batteries.—H. A. W. Klinkhamer. (*Philips tech. Rev.*, 1947/1948, Vol. 9, No. 8, pp. 231–238.)

621.396.681 **2379**

Servicing Vibrator Packs.—(*Radio & Electronics, Wellington, N.Z.*, 1st Jan. 1948, Vol. 2, No. 10, pp. 25–27, 31.) The principal features of synchronous and non-synchronous vibrators are described and practical servicing procedures are given.

621.396.682 : 621.316.722.1 **2380**

Controlled Power Sources for Heavy Direct Currents.—G. Houck. (*Electronic Industr.*, Dec. 1947, Vol. 1, No. 12, pp. 12–13.) A general description of a commercial unit, the 'nobatron', which supplies 50–350 A d.c. at 28 V from a 3-phase supply. Voltage regulation is better than 0.1% for a load change from 50 to 300 A. See also 284 of January.

621.396.69 : 621.315 **2381**

F.M. and TV Transmission Line Installation Problems : Part 2.—J. S. Brown. (*Communications*, Jan. 1948, Vol. 28, No. 1, pp. 20–21.) Illustrations and some details of equipment at WBNS–WELD, Columbus. Part 1, 1176 of April.

621.385.832 : 778 **2382**

Photographic Recording of Cathode-Ray Tube Traces. [Book Review]—R. J. Hercock. Ilford Ltd, London, 1947, 60 pp., 5s. (*Proc. phys. Soc.*, Nov. 1947, Vol. 59, No. 336, p. 1048.) No. 1 of a series of Ilford technical monographs ; its object is to provide those familiar with the use of c.r. tubes with an insight into the photographic technique necessary to obtain useful records of traces.

TELEVISION AND PHOTOTELEGRAPHY

621.397.26 **2383**

The New Radio Picture Service.—(*Radio & Electronics, Wellington, N.Z.*, 1st Jan. 1948, Vol. 2, No. 10, pp. 4–5.) A brief description of the crystal-controlled equipment used for the service recently inaugurated between London, Australia and New Zealand.

621.397.26 **2384**

A Method of Transmitting Sound on the Vision Carrier of a Television Service.—D. I. Lawson, A. V. Lord & S. R. Kharbanda. (*J. Instn elect. Engrs*, Part III, Jan. 1948, Vol. 95, No. 33, pp. 13–16.) Discussion on 3091 of 1946.

621.397.331.2 **2385**

Limiting Resolution in an Image-Orthicon-Type Pickup Tube.—H. B. DeVore. (*Proc. Inst. Radio Engrs, W. & E.*, March 1948, Vol. 36, No. 3, pp. 335–345.) The distribution of charge spreading across alternate illuminated and dark strips is found and the potential due to the varying charge is expressed as a modulation, which is a function of the target thickness. For a given resolution, the target thickness required is proportional to the target resistivity. Target area and charge density are discussed by calculating electron transit times and displacements from the true focus. Variation of the degree of modulation with the wavelength of the incident light is investigated.

621.397.335 **2386**

Frame Time Base Synchronisation in Television Receivers.—A. W. Keen. (*J. Televis. Soc.*, June 1947, Vol. 5, No. 2, pp. 49–64.) A detailed discussion of the characteristics of framing-signal separators using (*a*) frequency selective networks ; (*b*) shaping networks ; (*c*) delay networks ; (*d*) combination with a locally-generated signal ; (*e*) automatic frequency and phase control.

621.397.5 : 535.88 **2387**

Home Projection Television : Parts 1-3.—H. Rinia, J. de Gier & P. M. van Alphen ; G. J. Siezen & F. Kerkhof ; J. Haantjes & F. Kerkhof. (*Proc. Inst. Radio Engrs, W. & E.*, March 1948, Vol. 36, No. 3, pp. 395–411.)

Part 1. Cathode-Ray Tube and Optical System.

The 2.5-inch tube has a very small spot size, narrow neck, face plate ground to meet optical requirements, and metal-backed screen. A modified Schmidt projection system is used, with aspherical correction plates prepared by a simple method from gelatine solution.

Part 2. Pulse-Type High-Voltage Supply.

A compact 25 kV unit with automatic voltage control. A voltage tripling circuit with miniature rectifiers is used. Resonant circuit losses are kept low by means of a low-loss magnetic ferrite material.

Part 3. Deflection Circuits.

Description of magnetic deflection circuits adaptable to either projection or direct-viewing receivers, and an interlace method using the first serration in the vertical synchronizing signal. The horizontal deflection output stage includes a power valve and also a diode which improves power economy and sweep linearity and suppresses spurious oscillations. See also 2408 below.

621.397.6 **2388**

Simplified Signal and Pattern Generators.—G. T. Clack. (*J. Televis. Soc.*, June 1947, Vol. 5, No. 2, pp. 75–80.) Construction and circuit details of two instruments for amateur use.

621.397.6 **2389**

Television Field Equipment.—J. H. Roe & N. S. Bean. (*F.M. & Televis.*, Nov. 1947, Vol. 7, No. 11, pp. 31–35.) Illustrated description of camera, camera control, and power supply units.

621.397.6 : 621.396.68 **2390**

Television E.H.T. Supply: Parts 1 & 2.—A. H. B. Walker. (*Wireless World*, April & May 1948, Vol. 54, Nos. 4 & 5, pp. 120–125 & 169–173.) The need for a well-regulated supply is stressed and performance requirements are discussed. The relative merits of three alternative systems are considered: (*a*) h.v. mains transformer and half-wave rectifier; (*b*) h.f. oscillator and rectifier; (*c*) use of line fly-back pulses. A method of voltage multiplication using combinations of rectifiers and capacitors is also described. Data for suitable rectifiers are tabulated.

621.397.62 **2391**

Considerations in Design of Home Constructed Receivers: Part 1.—W. I. Flach. (*J. Televis. Soc.*, March 1947, Vol. 5, No. 1, pp. 10–12.) Abstracted with part 2, 2392 below.

621.397.62 **2392**

A Television Receiver for the Home Constructor: Part 2.—W. I. Flach. (*J. Televis. Soc.*, June 1947, Vol. 5, No. 2, pp. 65–73, 80.) Full circuit details of the receiver noted in 577 of February, with discussion of the considerations leading to the choice of components and circuits. Part 1, 2391 above.

621.397.62 : 621.317.2 **2393**

Television Receiver Laboratory.—Norton. (*See* 2279.)

621.397.743 : 621.396.65.029.64 **2394**

F.M. Relay out-performs Coax for Television.—Sleeper. (*See* 2370.)

TRANSMISSION

621.396.61/.62 **2395**

The Design of Transmitter Drives and Receivers for Single-Sideband Systems.—W. J. Bray, H. G. Lillicrap & W. R. H. Lowry. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 12, pp. 298–312.) The present system of single-sideband transmission incorporates two channels each 6 kc/s wide, on either side of a reduced-level pilot carrier 26 db below the sideband peak level.

The following equipment to provide this service is described: (*a*) a low-power drive stage; (*b*) a monitor receiver which enables either channel of the r.f. signal to be demodulated for tests of quality and distortion; (*c*) single-sideband receivers for single-aerial and triple-diversity-spaced-aerial operation at the receiving end of a radio link. The design, layout and performance of a typical receiver are discussed.

621.396.61 : 621.316.726 **2396**

Frequency Composition in Naval Communication Transmitters.—Hupert. (*See* 2278.)

621.396.61 : 621.396.932 **2397**

The Design of Marine Transmitter Equipments Type "Trader" and "Oceanspan".—D. F. Bowers & E. F. Cranston. (*Marconi Rev.*, Oct./Dec. 1947, Vol. 10, No. 87, pp. 133–141.) Circuit details and principal features. The 'Trader' equipment covers only the m.f. band 375–500 kc/s and on c.w. delivers 100 W to the aerial; on m.c.w. the output is 120 W. The 'Oceanspan' covers both the m.f. and h.f. bands (3.5–23 Mc/s). The h.f. oscillator is quartz-controlled, 10 crystals being used, with suitable frequency multipliers and switching arrangements.

621.396.61.001.4 : 621.317.755 **2398**

Uses of the Cathode-Ray Oscillograph in Transmitter Adjustment and Control.—Coombs. (*See* 2290.)

621.396.61.029.58 : 621.396.712 **2399**

International Broadcast H.F. Transmitter with Continuously Tunable Plate System.—D. A. Miller. (*Communications*, Jan. 1948, Vol. 28, No. 1, pp. 10–13, 28.) The mechanical and electrical design of the 20-kW output stage. The frequency range is 2.85–22.5 Mc/s. The anode coil is made from Ag-plated Cu tube and has mycalex supports. A short-circuiting spider is geared to a tuning handle on the front panel. Mycalex supports are also used for the plates of the anode-tuning capacitor. Frequency drift is low. Temperature rise is only 5°C after several hours' operation.

621.396.61.029.62 **2400**

A Mobile Midget for 144 Mc/s.—C. V. Chambers. (*QST*, Feb. 1948, Vol. 32, No. 2, pp. 21–27.) Circuit and construction details. The crystal-controlled transmitter has an output of 5 W. One 6J6 is used as a 48-Mc/s oscillator and frequency tripler, followed by a second 6J6 as push-pull amplifier; a 6AQ5 is used as modulator. Current is measured by switching to 100-Ω resistors in various leads.

621.396.611.33 : 621.396.671 **2401**

Determination of Matching Ranges [plages d'adaptation] **of Transmitters in the case of Indirect Inductive Coupling to the Aerial.**—V. Familier. (*Onde élect.*, March 1948, Vol. 28, No. 252, pp. 108–114.) The aerial is coupled to an oscillatory anode circuit (L_1C). Simple constructions for the matching surfaces are given for various combinations of conditions in which C, L_1, L_2 and K are variable. L_2 is the self-inductance of the aerial coupling coil and K the coupling coefficient for L_1 and L_2. See also 1958 of 1947 (Glazer & Familier).

621.396.615 **2402**

F.M. Master Oscillator of U.S.W. Transmitter for High-Fidelity Broadcasting.—M. G. Margolin. (*Radiotekhnika, Moscow*, May/June 1947, Vol. 2, No. 5, pp. 19–33. In Russian, with English summary.) Circuits and design theory of an experimental 1-kW equipment at Moscow. A zero-beat discriminator is used for stabilizing the centre frequency.

621.396.619.11/.13 **2403**

Generalized Theory of Multitone Amplitude and Frequency Modulation.—L. J. Giacoletto. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1948, Vol. 36, No. 2, pp. 240–243.) Discussion on 3700 of 1947.

621.396.619.13 : 621.317.76 **2404**

F.M. Monitor has Pulse-Counter Discriminator.—Cady. (*See* 2291.)

621.396.619.15 **2405**

Frequency-Shift Radio Transmission.—L. E. Hatfield. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1948, Vol. 36, No. 1, pp. 116–120.) Various methods of obtaining carrier-frequency shift in communications transmitters are discussed, and a satisfactory reactance-type frequency-shift transmitter keyer is fully described. See also 275 of 1947 (Buff).

621.396.619.23 **2406**

Frequency Modulators with Reactance Valves.—I. S. Gonorovski. (*Radiotekhnika, Moscow,* May/June 1947, Vol. 2, No. 5, pp. 3–18. In Russian, with English summary.) Design theory is given for a modulator using a reactance valve for frequency control of a self-oscillator. Parasitic a.m. is considered and various methods of coupling the reactance valve to the oscillator are investigated. Tests on an experimental 1-kW f.m. u.s.w. broadcast transmitter at Moscow are discussed.

VALVES AND THERMIONICS

537.291 **2407**

On Using the Energy of Electrons moving in H.F. Uniform Electric Fields.—M. S. Neiman. (*Radiotekhnika, Moscow,* Jan./Feb. 1948, Vol. 3, No. 1, pp. 3–21. In Russian.) Discussion of the movement of an electron between two parallel grids to which a h.f. voltage is applied, with particular reference to (*a*) conditions for complete and partial retardation of the electron when the transit time τ is large, (*b*) more general cases when τ is not an odd number of half cycles and the electron enters the space between the grids at any phase, (*c*) the current induced by the electron in the external circuit setting up the field, (*d*) a passive circuit where the voltage between the grids is due entirely to the energy liberated by the retardation of electrons, (*e*) the motion of an electron beam between the grids, and the beam retardation, when τ is large, (*f*) the effect of superimposing a constant voltage upon the alternating voltage.

537.291 + 538.691] : 621.396.615 : 518.5 **2408**

Tracing of Electron Trajectories using the Differential Analyzer: Introduction & Parts 1-3.—J. P. Blewett; G. Kron, F. J. Maginnis & H. A. Peterson; W. C. Hahn & J. P. Blewett; J. R. Whinnery & H. W. Jamieson. (*Proc. Inst. Radio Engrs, W. & E.,* Jan. 1948, Vol. 36, No. 1, pp. 69–83.)

Introduction.

The differential analyser is used to obtain electron trajectories for magnetron and triode oscillators with d.c. and r.f. anode potential. A d.c. space charge is approximately allowed for in the case of the magnetron; otherwise space charge is neglected.

Part 1. Differential Analyzer Representation.

Part 2. Electron Paths in Magnetrons.

The work hitherto done has been largely exploratory; although the differential analyser solutions are rather sensitive to errors in flux plotting, they give promise of yielding much valuable information about magnetron behaviour.

Part 3. Study of Transit-Time Effects in Disk-Seal Power-Amplifier Triodes.

The 2C39 power amplifier is discussed. Anode efficiency of about 50% and power gain of 8 or 9 should be obtained at 3 000 Mc/s. Improvement in cavity and plunger design increased the anode efficiency from about 10% to 20%, which is much less than the 50% predicted. The largest loss of d.c. power comes from anode dissipation; in a triode there is a fundamental conflict between the desire for small transit times and that for low anode impact velocity.

621.385.029.63/.64 **2409**

Experimental Determination of Helical-Wave Properties.—C. C. Cutler. (*Proc. Inst. Radio Engrs, W. & E.,* Feb. 1948, Vol. 36, No. 2, pp. 230–233.) The properties of the wave propagated along the helix of a travelling-wave amplifier are discussed. Measurements of axial field strength, of field distribution around the helix, and of the velocity of propagation are discussed. The actual field in the helix is slightly weaker than that predicted by Pierce (2284 of 1947) for a hypothetical helical surface.

621.385.1 **2410**

British Sub-Miniature Valves.—(*Wireless World,* March 1948, Vol. 54, No. 3, pp. 80–81.) A new Mullard series, with 25-mA oxide-coated tungsten filaments of extremely small diameter. Operating data are tabulated for a voltage amplifying pentode DF70, and for output pentodes DL71, DL72, as used in hearing-aid circuits. Gain is practically independent of filament voltage over a wide range. Overall dimensions compare favourably with those of corresponding American types.

621.385.1 : 621.396.619.16 **2411**

Electron Beam Deflection Tube for Pulse Code Modulation.—R. W. Sears. (*Bell Syst. tech. J.,* Jan. 1948, Vol. 27, No. 1, pp. 44–57.) An experimental 7-digit tube is described. Rapid coding is achieved by a system which compares signal amplitude with a set of scaled levels and generates a group of on-off pulses identifying the appropriate level. A perforated code masking plate, fitted in front of the output plate, modulates the electron beam to give the pulses required. A parallel-wire grid provides feedback to lock the beam to each discrete amplitude level. See also 2366 above.

621.385.1.029.6 + 621.396.694 **2412**

Valves and Circuits for Ultra-Short Waves.—R. Suart. (*Radio franç.,* Feb. 1948, pp. 17–23.) A concise description of the construction of disk-seal and lighthouse valves, with electrical data for British valves CV257 and CV273, American 2C40, French CX103, CX104 and CX105, and details of tuning methods using coaxial lines or cavity resonators. All the valves mentioned can be used for pulse generation, in which case the peak power is about 500 times that quoted for c.w. operation.

621.385.1.029.6 **2413**

The Behaviour of Receiving Valves at U.H.F. and Related Technical Problems.—L. Piatti. (*Alta Frequenza,* June 1944, Vol. 13, No. 2, pp. 67–94. In Italian, with English, French and German summaries.) Reasons are discussed for the different behaviour of receiving valves at very short and at broadcasting wavelengths. The effects of the finite electron transit time between the electrodes on the four admittances of a valve, and the similar effects of the inductances of electrode leads, are analysed as functions of frequency. Noise is considered and its importance at u.h.f. stressed. The ideal features of a receiving valve for u.h.f. are derived and the physical characteristics of some special valves are described.

621.385.1.032.216 **2414**

The *i/V* Characteristic of the Coating of Oxide Cathodes during Short-Time Thermionic Emission.—R. Loosjes & H. J. Vink. (*Philips Res. Rep.,* June 1947, Vol. 2, No. 3, pp. 190–204.) The potential differences existing across an oxide coating during short-time emission were investigated by subjecting experimental indirectly-heated diodes with sliding anodes to a recurring capacitor discharge. The time constant was 10^{-4} sec and the pulse recurrence frequency 25–50 c/s.

Using a specially developed oscillograph technique, *i/V* characteristics were plotted for varying anode/cathode distances; the value of the potential difference across the oxide coating was found by extrapolating to zero distance.

At normal working temperatures in the range 900–1 100°K and for current densities of 5–10 A/cm², potential differences of 50–200 V existed across the oxide coating. It is shown theoretically that the i/V curves obtained by this method are a good approximation.

621.385.1.032.216 **2415**

On the Activation of Oxide-Coated Cathodes.—H. C. Hamaker, H. Bruining & A. H. W. Aten, Jr. (*Philips Res. Rep.*, June 1497, Vol. 2, No. 3, pp. 171–176.) Glass heated to 400°C during degassing can emit a small amount of HCl; chloride deposits are thus formed on anodes and grids. Under electron bombardment these chlorides decompose and poison the cathode emission.

621.385.832 **2416**

The Design and Construction of Cathode Ray Tubes.—R. H. Craig. (*Nickel Bull.*, March 1948, Vol. 21, No. 3, pp. 30–33.) General design considerations, with special reference to the materials used for the electrodes and deflector systems, and to construction details for accurate alignment of the electrode assembly and for good spot quality.

621.396.615.141.2 **2417**

Methods of Tuning Multiple-Cavity Magnetrons.—R. B. Nelson. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1948, Vol. 36, No. 1, pp. 53–56.) The most successful method of tuning involves simultaneous variation of both the inductance and capacitance of all the resonant cavities by a single tuning motion. Tuning ranges of better than 1.4 : 1 have thus been obtained with good efficiency. A magnetron is described which can deliver over 2 kW c.w. power at any frequency between 760 and 1 160 Mc/s.

621.396.822 **2418**

A Unified Theory of Spontaneous Electrical Fluctuations in Thermionic Valves.—R. Fürth. (*Nature, Lond.*, 13th Dec. 1947, Vol. 160, No. 4076, pp. 832–833.) It is asserted that thermal fluctuation and shot effect are in general only two aspects of one and the same statistical fluctuation process, which can be theoretically treated by the application of the principles of statistical thermodynamics. An approximate formula for the shot effect in diodes, which covers the whole range of the characteristic, may readily be derived. Certain anomalous data presented by MacDonald (953 of 1947) are explained by the theory.

621.396.822 **2419**

On the Theory of Electrical Fluctuations.—R. Fürth. (*Proc. roy. Soc. A*, 18th March 1948, Vol. 192, No. 1031, pp. 593–615.) A critical analysis of the fundamental principles of the theory of thermal fluctuations of electricity, with a new derivation of Nyquist's theorem. Examination of the methods of derivation of the formulae for 'shot' fluctuations suggests that they are in fact identical with thermal fluctuations. On this basis a general formula for the shot effect in diodes is given which should be valid throughout the whole range of the characteristic.

621.396.822 **2420**

Valve Noise and Transit Time.—N. R. Campbell, V. J. Francis & E. G. James. (*Wireless Engr*, May 1948, Vol. 25, No. 296, pp. 148–157.) Earlier treatments of valve noise in diodes and triodes are extended to allow for the transit time of the electrons. The reaction of the valve to a sinusoidal input is analysed and modifications of the formulae are then made to allow for the finite duration of the noise events, involving a discussion of the charge induced on the grid by an electron as it approaches and recedes. Discussion of measurement results indicates that the assumptions made in previous analyses by Bakker (*Physica*, 1941, Vol. 8, p. 23) and by Benham (1928 Abstracts, p. 288 and 1931 Abstracts, p. 212) are of doubtful applicability to valves of practical importance. See also 1191 and 1471 of 1946.

621.396.822 **2421**

Noise in Resistances and Electron Streams.—Pierce. (*See* 2220.)

621.392 + 621.385 **2422**

Electronic Circuits and Tubes. [Book Review]—War Training Staff of the Cruft Laboratory, Harvard University. (*See* 2222.)

MISCELLANEOUS

002 : 778.1 **2423**

Proposed Central Publication of Scientific Papers.—W. Davis. (*Nature, Lond.*, 5th June 1948, Vol. 161, No. 4101, p. 896.) Description of a method of auxiliary publication used in the U.S.A. since 1936. Original scientific papers can be deposited by journal editors with the American Documentation Institute, Washington, D.C.; a catalogue of documents deposited is available. Journals can publish a summary (long or short) of the article, and insert the number of the document deposited, and the price of a microfilm or enlarged photoprint. Only the original document and the microfilm negative need be stored. Copies are ordered directly by readers from the American Institute of Documentation. Neither the journal editor nor the author incurs any financial liability.

371.3 : 621.3 **2424**

The Practical Training of Professional Electrical Engineers.—(*J. Instn elect. Engrs*, Part I, Oct. 1947, Vol. 94, No. 82, pp. 437–446.) Report of a committee appointed by the Councils of the British Electrical and Allied Manufacturers' Association, the Radio Industry, and the Institution of Electrical Engineers. Recommendations are made for two types of apprenticeship: a graduate apprenticeship lasting 2 years, and a student apprenticeship, with technical education by part-time study, lasting 4 years.

522.1(42) Greenwich **2425**

The Royal Observatory, Greenwich.—H. Spencer Jones. (*Endeavour*, Jan. 1948, Vol. 7, No. 25, pp. 9–14.) A short historical account of the observatory and its equipment. Removal to Herstmonceaux Castle, Sussex, is in progress.

621.3(083.74) **2426**

On the Use of Standard Terms and Abbreviations.—G.W.O.H. (*Wireless Engr*, March 1948, Vol. 25, No. 294, pp. 67–69.) General discussion, including a suggestion that 'ampere' should be shortened to 'amp'.

621.3(083.74) **2427**

Standard Terms and Abbreviations.—M. G. Scroggie. (*Wireless Engr*, April 1948, Vol. 25, No. 295, pp. 130–131.) Favours the adoption of 'amp' for the unit of current and also the practice of using lower-case letters for initial abbreviations of words which would begin with them if written in full, such as i.f., a.g.c. and a.c.

621.3(083.74) **2428**

Standard Terms and Abbreviations.—E. D. Hart: L. F. Odell. (*Wireless Engr*, May 1948, Vol. 25, No. 296, pp. 164–165.) Comment on 2426 and 2427 above. Reasons are given in favour of the contraction of 'ampere' to 'amp', the use of 'K' instead of 'k' for 'Kilo', and of 'dB' instead of 'db' for 'decibel'. The use of lower-case letters in abbreviations is also considered.

621.396 **2429**

The Inventor of Radio Telegraphy.—G.W.O.H. (*Wireless Engr*, May 1948, Vol. 25, No. 296, pp. 135–137.) A discussion of the evidence regarding the earliest experiments in wireless telegraphy. Recent claims that Popov had a working system earlier than that of Marconi do not appear to be supported by the evidence. See also 1842 of June and back references.

ABSTRACTS and REFERENCES

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to it.

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ACOUSTICS AND AUDIO FREQUENCIES

534 + 621.395.6 **2430**

1948 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs, W. & E.*, March 1948, Vol. 36, No. 3, pp. 365–380.) Abstracts are given of the following papers read at the Convention:—Ratio of Frequency Swing to Phase Shift in Phase- and Frequency-Modulation Systems Transmitting Speech, by D. K. Gannett & W. R. Young. Phase Distortion in Audio Systems, by L. A. de Rosa. Design Characteristics of Hearing-Aid Tubes, by G. W. Baker. Modern Design Features of C.B.S. Studio Audio Facilities, by R. B. Monroe & C. A. Palmquist. Methods of Calibrating Frequency Records, by R. C. Moyer, D. R. Andrews & H. E. Roys. Distortions in Magnetic Tape Recording due to the Configuration of the Bias Field, by S. J. Begun. Instantaneous Audience-Measurement System (IAMS), by P. C. Goldmark, J. W. Christensen, A. Bark & J. T. Wilner. Methods for Visual Observation of Patterns recorded on Magnetic Media, by S. N. Alexander, L. Marton & I. L. Cooter. Simplification of the Theory of Supersonic Interferometry, by F. E. Fox & J. L. Hunter. Titles of other papers are given in other sections.

534.321.9 : 621.392.5 **2431**

Ultrasonic Delay Lines: Parts 1 & 2.—Huntington, Emslie & Hughes; Emslie, Huntington, Shapiro & Benfield. (*See* 2479.)

534.41 + 534.781] : 621.383 **2432**

Photo-Electric Fourier Transformer and its Application to Sound-Films.—D. Brown & J. W. Lyttleton. (*Nature, Lond.*, 22nd Nov. 1947, Vol. 160, No. 4073, p. 709.) A device similar to that of Born, Fürth & Pringle (656 of 1946) for producing a continuous analysis of tones recorded on sound film. The chief differences are: (*a*) the use of a finer grating to analyse the higher audio frequencies, (*b*) moving the film itself steadily past the optical aperture instead of using a mask or silhouette representing the function to be analysed, and (*c*) recording by intensity modulation of a c.r.o. beam. A progressive frequency spectrum of the spoken word 'there' is shown as analysed by the device. See also 3517 of 1946 (Koenig et al.).

534.422 **2433**

High-Intensity Sound Waves now Harnessed for Industry.—R. W. Porter. (*Chem. Engng*, 1948, Vol. 55, pp. 100–101, 115.) An ultrasonic high-intensity sound generator consists essentially of a high-speed air siren driven by a variable-speed air turbine. Compressed air passes into a rotating hollow disk and then radially outwards through stationary peripheral vanes. The pulsations are focused on a reflector by horns in the stator. Industrial applications include carbon-black agglomeration, soda recovery from flue gases, and the spray drying of powdered soap. See also 1533 of June (Allen, Frings & Rudnick). [Extracted from British Abstracts.]

534.612 : 534.417 **2434**

The Calibration of Hydrophones and Crystal Transceivers.—N. F. Astbury. (*Proc. phys. Soc.*, 1st Feb. 1948, Vol. 60, No. 338, pp. 193–202.) A discussion of measurements from which absolute determinations of sound-field pressure can be made, and also of the relation between these measurements and the reciprocity method. The axial pressure and 'projection efficiency' of a transceiver are deduced, the 'projection efficiency' being defined as the ratio of the actual axial intensity to the intensity as it would be if the transceiver converted the whole energy absorbed into sound by vibrating as a simple piston.

534.851 **2435**

Design of Audio Compensation Networks.—W. A. Savory. (*Tele-Tech*, Jan., Feb. & April 1948, Vol. 7, Nos. 1, 2 & 4, pp. 24–27, 27–29, 72 & 34–35..65.) Discussion of design procedures for correct frequency-response equalization in gramophone reproduction. Circuits for low- and high-frequency correction are considered separately and charts are given for numerical calculation of the optimum values of circuit components. The circuit of a preamplifier with a 6-position combined low-frequency crossover and high-frequency correction is also given.

534.851 : 621.395.813 : 621.396.662.3 **2436**

Filter Characteristics for the Dynamic Noise Suppressor.—L. G. McCracken. (*Electronics*, April 1948, Vol. 21, No. 4, pp. 114–115.) A mathematical analysis for Scott's noise suppressor (932 of April).

534.861.1 : 534.833 **2437**

Acoustic Problems in Studio Design.—G. M. Nixon. (*Electronics*, May 1948, Vol. 21, No. 5, pp. 86–89.) Discussion of the construction of walls, ceiling and floor to attenuate airborne noise and that due to transmission of vibrations.

621.395.61/.62 : 629.135 **2438**

Electro-Acoustic Transducers and Intercommunication Systems for Aircraft.—W. Makinson. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 13, pp. 441–451 ; summary, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 82.) Discussion of : (*a*) the mechanism of speech communication in and from noisy locations, (*b*) the requirements thereby imposed on the design of transducers and audio circuits, (*c*) instruments used in the R.A.F., (*d*) proposed future systems.

621.395.61.012 + 621.395.623.7.012 **2439**

Graphical Analysis of Speakers and Microphones.—A. J. Sanial. (*Tele-Tech*, Feb. 1948, Vol. 7, No. 2, pp. 42–43.) A curve tracer is described in which a recording drum, rotated by hand, is coupled to the independent variable, while the dependent variable is displayed on a meter. The meter needle is followed by a tracking pointer which actuates the marking pen.

621.395.623.7 **2440**

Monitoring Loudspeakers.—(*Wireless World*, May 1948, Vol. 54, No. 5, p. 186.) A report of a discussion on methods of assessing the quality of a loudspeaker. An instrument is needed which would interpret the results of measurements, so that subjective listening tests could be superseded.

621.395.625 **2441**

The Recording and Reproduction of Sound : Parts 11-13.—O. Read. (*Radio News*, Jan.–March 1948, Vol. 39, Nos. 1–3, pp. 54–56..170, 56–58..140 & 62–64..154.) Design details for a high-quality a.f. amplifier. Analysis of the mechanical and electrical requirements in the design of magnetic tape recorders. Characteristics of cutting styli. Parts 8–10, 1545 of June.

621.395.92.001.4 **2442**

Cavity Pressure Method for Measuring the Gain of Hearing Aids.—E. L. R. Corliss & G. S. Cook. (*Bur. Stand. J. Res.*, Jan. 1948, Vol. 40, No. 1, pp. 85–91.) For another account see 2157 of August.

AERIALS AND TRANSMISSION LINES

621.315 + 621.392 + 621.396.67 **2443**

1948 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs, W. & E.*, March 1948, Vol. 36, No. 3, pp. 365–380.) Abstracts are given of the following papers read at the Convention :—Physical Limitations of Directive Radiating Systems, by L. J. Chu. The Radiation Resistance of an Antenna in an Infinite Array or Waveguide, by H. A. Wheeler. Reflectors for Wide-Angle Scanning at Microwave Frequencies, by R. C. Spencer, W. Ellis & E. C. Fine. Measured Impedance of Vertical Antennas over Finite Ground Planes, by A. S. Meier & W. P. Summers. An Omnidirectional High-Gain Antenna for Circularly Polarized Radiation, by A. G. Kandoian. Analysis of Effect of Circulating Currents on the Radiation Efficiency of Broadcast Directive Antenna Designs, by G. D. Gillett. A Model Study of Reradiation from Broadcast Towers, by A. Alford & H. Jasik. Helical-Beam Antenna for Wide-Band Applications, by J. D. Kraus. A Circular-Polarization Antenna for F.M., by C. E. Smith & R. A. Fouty. Simplified Procedure for Computing the Behavior of Multiconductor Lossless Transmission Lines, by S. Frankel. Optimum Geometry for Ridged Waveguide, by W. E. Waller, S. Hopfer & M. Sucher. Fields in Nonmetallic Waveguides, by R. N. Whitmer. A Wide-Band Wave-Guide-Filter Structure, by S. B. Cohn. The Transmission-Line Vector Diagram, by W. C. Ballard, Jr. Analysis and Performance of Waveguide Hybrid Rings for Microwaves, by H. T. Budenbom. Analysis of a Microwave Absolute Attenuation Standard, by A. B. Giordano. Titles of other papers are given in other sections.

621.315 **2444**

Rigorous and Approximate Treatment of Long Line Transmission Problems by Hyperbolic Functions.—S. Gerszonowicz. (*J. Franklin Inst.*, Jan. 1948, Vol. 245, No. 1, pp. 53–66.)

621.392.029.64 **2445**

Waveguides.—A. V. J. Martin. (*Radio tech. Dig., Édn franç.*, Feb. 1948, Vol. 2, No. 1, pp. 5–20.) Discusses field distributions for both circular and rectangular waveguides, cut-off frequencies, effect of dielectrics, attenuation, losses, standard dimensions, and gives appropriate formulae.

621.392.029.64 **2446**

Anomalous Attenuation in Waveguides.—J. Kemp. (*Elect. Commun.*, Sept. 1947, Vol. 24, No. 3, pp. 342–348.) Reprint of 2818 of 1946. See also 3540 of 1946 (Bell).

621.392.029.64 : 621.3.09 **2447**

Propagation of a Perturbation in a Waveguide.—M. Cotte. (*C. R. Acad. Sci., Paris*, 5th Nov. 1945, Vol. 221, No. 19, pp. 538–540.) Formulae are obtained for a perturbation which can be resolved into waves of the same type, but of different frequencies, propagated in a straight waveguide with perfectly conducting walls.

621.396.67 **2448**

The Practical Aspects of Paraboloid Aerial Design.—J. D. Lawson. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 10, pp. 1511–1522.) Discussion of : (*a*) the properties of paraboloid aerials, (*b*) the design and impedance characteristics of the dipoles, slots, and waveguides used to excite them, (*c*) split-beam technique and the methods used to obtain special directional patterns, (*d*) the three-phase tripole, which gives circularly polarized radiation.

621.396.67 **2449**

Polyrods.—G. E. Mueller. (*Bell Lab. Rec.*, Feb. 1948, Vol. 26, No. 2, pp. 64–67.) Dielectric rods for scanning arrays have high electrical efficiency and relative freedom from external disturbances. Tapering the rods improves their characteristics.

621.396.67 **2450**

Coupled Antennas.—C. T. Tai. (*Proc. Inst. Radio Engrs, W. & E.*, April 1948, Vol. 36, No. 4, pp. 487–500.) An extension of the work of King & Harrison (3474 of 1944). The integral equation governing the current distribution on two coupled cylindrical dipoles of equal length is solved, and mutual impedances calculated from it agree substantially with the results of Carter's classical simple theory (1932 Abstracts, p. 585) of the mutual impedance between two half-wave filament dipoles. Curves of current distributions and impedance are given as a function of spacing for half- and full-wave dipoles of various length/diameter ratios.

621.396.67 **2451**

The Radiation Resistance of an Antenna in an Infinite Array or Waveguide.—H. A. Wheeler. (*Proc. Inst. Radio Engrs, W. & E.*, April 1948, Vol. 36, No. 4, pp. 478–487.) I.R.E. 1948 National Convention paper. The e.m. field in front of an infinite flat array of aerials can be subdivided into wave channels, each including one of the aerials. The radiation resistance of each aerial can then be derived simply. In a large flat array of $\lambda/2$ dipoles, each allotted a $\lambda/2$-square area, backed by a plane reflector $\lambda/4$ distant, the radiation resistance of each dipole is $480/\pi = 153\ \Omega$, except for the dipoles near the edges. The method may also be used to calculate the radiation resistance of an aerial in a rectangular waveguide, previously derived by more complicated methods.

621.396.67 **2452**

On the Theoretical Functioning of some Types of Centimetric Linear Arrays.—R. B. R.-Shersby-Harvie. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 10, pp. 1548–1553.) Their functioning is explained in terms of filter theory. Both resonant and non-resonant types of array are considered, but mainly the latter; the theory of each is investigated, first neglecting mutual interaction between the elements and then for the more general case.

621.396.67 **2453**

The Hoghorn — an Electromagnetic Horn Radiator of Medium-Sized Aperture.—A. B. Pippard. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 10, pp. 1536–1538.) A compact horn, fed by a waveguide, which gives a beamwidth at half power of 4–15° in the plane of maximum directivity and 25° or less in the perpendicular plane.

621.396.67 **2454**

Antenna Design for Low-Angle F.M. Propagation.—O. O. Fiet. (*Tele-Tech*, Feb. 1948, Vol. 7, No. 2, pp. 30–33.) Description of R.C.A. ' Pylon ' omnidirectional slotted cylindrical transmitting aerials for television and f.m., with construction and feeder connection details. The electrical characteristics and the methods used for determining the gain and vertical field strength pattern are discussed.

621.396.67 : 621.318.572 **2455**

Electronic Switches for Single-Aerial Working.—Cooke, Fertel & Harris. (*See* 2643.)

621.396.67 : 621.396.931 **2456**

Antennas for Citizens Radio : Part 3.—H. J. Rowland. (*Electronics*, May 1948, Vol. 21, No. 5, pp. 96–99.) High gain is particularly important because of transmitter power limitations, but is readily obtainable in the 460–470-Mc/s band. Designs for broadcast and point-to-point service are discussed. Part 1 : 855 of March (Hollis). Part 2 : 2341 of August (Hollis).

621.396.67 : 621.396.933 **2457**

Recent Developments of Aircraft Communication Aerials.—W. A. Johnson. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 13, pp. 452–458 ; summary, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 82.) A survey of design progress. The impedance characteristics of several typical aerials are given.

621.396.67.029.63 **2458**

Experiments with Yagi Aerials at 600 Mc/s.—R. V. Alred. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 10, pp. 1490–1496.) The object was to produce an array to give a narrow beam suitable for naval gun-control directors. The optimum dimensions of a dipole and eight directors were found for a pair of Yagi aerials at various spacings ; the conventional dipole reflector was replaced by a semicircular cylinder to increase the front-to-back ratio. The final design used three such pairs fed in parallel and having the appropriate phase difference to give beam switching. Side-lobes were minimized by adjusting the power distribution. Data on the change of impedance with frequency are included for two- and six-element arrays. Numerous polar diagrams and experimental and calculated data are also included.

621.396.67.029.64 **2459**

Some Recent Developments in the Design of Centimetric Aerial Systems.—D. W. Fry. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 10, pp. 1497–1510.) Discussion of : (*a*) the essential features of paraboloid aerials, (*b*) reflectors designed to give cosecant patterns, (*c*) the use of cylindrical parabolas and arrays of slots as line sources, (*d*) the application of slots to waveguide arrays, (*e*) fundamental points in the design of dielectric and metal-plate lenses, (*f*) the use of metal-plate lenses as polarization filters.

621.396.671 **2460**

A Method of Calculating the Field over a Plane Aperture required to produce a given Polar Diagram.—P. M. Woodward. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 10, pp. 1554–1558.) " A summation method, especially adapted for numerical computation, is evolved for finding the magnitude and phase of the field distribution over a plane aperture which will yield an approximation to a specified polar diagram on one side of the aperture plane."

621.396.671 **2461**

Aerial Gain and Polar Diagrams.—B. J. Starnecki. (*Wireless Engr*, June 1948, Vol. 25, No. 297, pp. 198–199.) Comment on 1861 of July (Saxton).

621.396.671 **2462**

A Method of Computing a Vertical Section of the Combined Polar Diagram of a Radio Aerial, a Flat Earth and a Vertical Screen.—N. Corcoran & J. M. Hough. (*Proc. phys. Soc.*, 1st Feb. 1948, Vol. 60, No. 338, pp. 203–210.) " The method described is based on the Sommerfeld formula for diffraction at an edge, combined with the effect of reflection at the earth. A table is given which reduces the amount of numerical work involved."

621.396.671 **2463**

Measuring F.M. Antenna Patterns with Miniature Antennas.—M. A. Honnell & J. D. Albright. (*Communications*, Feb. 1948, Vol. 28, No. 2, pp. 20–22.) Simple equipment for measuring vertical radiation patterns, the aerials being scaled down so that a measurement frequency of 3 000 Mc/s could be used. See also 2011 of 1947.

621.396.677 **2464**

Rhombic Antenna Arrays.—W. N. Christiansen. (*A.W.A. tech. Rev.*, Oct. 1947, Vol. 7, No. 4, pp. 361–383.) Discussion of : (*a*) power-gain calculation from the experimental determination of current distribution, (*b*) increasing radiation efficiency by the use of the re-entrant feeder line, tiered rhombics and interlaced arrays.

621.396.677 **2465**

Broadband Lens Antenna for Microwaves.—W. E. Kock. (*Electronics*, April 1948, Vol. 21, No. 4, pp. 108–110.) For another account see 2176 of August.

621.396.677 **2466**

Review of Basic Design Principles for Directive Aerials.—K. Fränz. (*Arch. elekt. Übertragung*, Nov./Dec. 1947, Vol. 1, Nos. 5/6, pp. 205–219.)

621.396.677 **2467**

Experiments with Slot Aerials in Corner Reflectors.—J. L. Putman & W. B. Macro. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 10, pp. 1539–1547.) The development and performance of an aerial for a mobile 200-Mc/s aircraft beam-approach system is described, with particular reference to the radiation pattern.

621.396.677 **2468**

The Effect of Flanges on the Radiation Patterns of Small Horns.—A. R. G. Owen & L. G. Reynolds. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 10, pp. 1528–1530.) Rectangular flanges were added to a horn whose aperture was $\frac{1}{4}\lambda \times 2\frac{1}{2}\lambda$ at 3 000 Mc/s. The effect of varying the lengths of the flanges and the angle contained between them is shown by a series of graphs. Long flanges containing an acute angle tend to give polar diagrams which are uniform, except for a ripple, over an arc but fall off very rapidly outside this arc. The production of polar diagrams having a dip in the forward direction is discussed.

621.396.677 : 621.392.029.64 **2469**

The Elimination of Standing Waves in Aerials employing Paraboloidal Reflectors.—A. B. Pippard & N. Elson. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 10, pp. 1531–1535.) A flat plate of suitable size fixed at the apex of a paraboloid prevents reflection at the orifice of the waveguide feeding it. The theory and application of the method are described, together with the effect on the polar diagram.

CIRCUITS AND CIRCUIT ELEMENTS

621.3.018.7 : 621.396.822 **2470**

Trapezoidal Waveform with Minimal Noise Factor.—M. Päsler. (*Frequenz*, Feb. 1948, Vol. 2, No. 2, pp. 52–55.) Mathematical discussion shows that the noise factor is least when the parallel sides of the trapezoid have a length ratio of 1 : 3. The noise factor is greatest for the rectangular waveform and has a relative maximum for a triangular waveform. Fourier spectra of these three cases are shown graphically.

621.318.572 **2471**

Coincidence Device of 10^{-8}—10^{-9} sec Resolving Power.—Z. Bay & G. Papp. (*Nature, Lond.*, 10th Jan. 1948, Vol. 161, No. 4080, pp. 59–60.) A modification of the Rossi type of circuit using electron multiplier tubes achieves a resolving power of about 5×10^{-9} sec. The output valve of the circuit is biased to respond only to a 2-V input pulse, corresponding to a coincidence through the G-M counters. Output pulses from these pass through the multiplier tubes to the grids of the first two valves of the circuit ; these have a common load delivering a pulse to the output valve. A direct method for measuring the resolving power is described.

621.318.572 : 621.397.335 **2472**

Counter Circuits for Television.—A. Easton & P. H. Odessey. (*Electronics*, May 1948, Vol. 21, No. 5, pp. 120–123.) Step-type counter circuits are used as frequency dividers for synchronizing generators. Their limitations, possible improvements and the relationship between parameters required to obtain stable operation are discussed.

621.319.4 **2473**

Effectiveness of Bypass Capacitors at V.H.F.—J. F. Price. (*Communications*, Feb. 1948, Vol. 28, No. 2, pp. 18–19, 32.) Q-meter measurements at 30 Mc/s and 100 Mc/s on 9 types of capacitor show that only the silvered-mica types could be regarded as satisfactory at these frequencies. Some of the other types tested were inductive rather than capacitive, particularly at the higher frequency.

621.319.4 : 621.396.828 **2474**

The Duct Capacitor.—A. Watton, Jr. (*Proc. Inst. Radio Engrs, W. & E.*, April 1948, Vol. 36, No. 4, pp. 550–553.) Describes a new type of feed-through screened by-pass capacitor for radio interference suppression.

621.39 **2475**

1948 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs, W. & E.*, March 1948, Vol. 36, No. 3, pp. 365–380.) Abstracts are given of the following papers read at the Convention :—F. M. Detector Tube with Instantaneous Limiting and Single-Circuit Discriminator, by R. Adler. Properties of Some Wide-Band Phase-Splitting Networks, by D. G. C. Luck. Theory and Design of Constant-Current Networks, by C. S. Roys & P. H. Chin. New Parameter-Adjustment Method for Network Transients, by M. J. Di Toro & R. C. Wittenberg. Application of Tchebyschef Polynomials to Design of Bandpass Filters, by M. Dishal. A Simplified Negative-Resistance-Type Q Multiplier, by H. E. Harris. Low Noise Amplifier, by H. Wallman, A. B. Macnee & C. P. Gadsden. Square-Wave Analysis of Compensated Amplifiers, by P. M. Seal. A New Figure of Merit for the Transient Response of Video Amplifiers, by R. C. Palmer & L. Mautner. Distributed Amplification, by E. L. Ginzton, W. R. Hewlett, J. H. Jasberg & J. D. Noe. A Wide-Band Wave-Guide-Filter Structure, by S. B. Cohn. Experimental Study of the Effects of Transit Time in Class-C Power Amplifiers, by O. Whitby. Phase-Corrected Delay Lines, by M. J. Di Toro. On the Theory of the Delay-Line-Coupled Traveling-Wave Amplifier, by H. G. Rudenberg. Losses in Air-Cored Inductors, by R. E. Field. A Simplified Design Procedure for Iron-Core Toroids, by H. E. Harris. A Network Analyzer for the Study of Electromagnetic Fields, by K. Spangenberg, G. Walters & F. W. Schott. Rectifier Networks for Multiposition Switching, by N. Rochester & D. R. Brown. Mercury Delay-Line Memory using a Pulse Rate of Several Megacycles, by I. L. Auerbach, J. P. Eckert, Jr, R. F. Shaw & C. B. Sheppard. Cavity Resonators for Half-Megavolt Operation, by A. E. Harrison. Synthesis of Dissipative Microwave Networks for Broad-Band Matching, by H. J. Carlin. Frequency Converters, by W. H. Lewis. Reactance-Tube Circuit Analysis, by R. C. Maninger. Electronically-Controlled Reactance, by J. N. Van Scoyoc & J. L. Murphy. The Photoformer, by D. E. Sunstein. Mode Separation in Oscillators with Two Coaxial-Line Resonators, by H. J. Reich. Frequency Stabilization with Microwave Spectral Lines, by W. D. Hershberger & L. E. Norton. Titles of other papers are given in other sections.

621.392 : 621.396.615.17 **2476**

Kinematic Definition of Discontinuous Relaxation Oscillations.—J. Abelé. (*C. R. Acad. Sci., Paris*, 26th Nov. 1945, Vol. 221, No. 22, pp. 656–658.) See also 2525 of 1946.

621.392.3 **2477**

Low-Impedance Reactances for V.H.F.—E. K. Stodola & H. Lisman. (*Electronics*, May 1948, Vol. 21, No. 5, pp. 93–95.) Flat-plate transmission lines can conveniently be used in both balanced and unbalanced circuits, especially for frequencies between 300 and 1 000 Mc/s. To obtain a low characteristic impedance, a high capacitance per unit length is required. This is easier to obtain with flat-plate lines than with cylindrical rods. Design requirements and applications to an amplifier and to a matching section are described.

621.392.5 **2478**

Design of Phantastron Time Delay Circuits.—R. N. Close & M. T. Lebenbaum. (*Electronics*, April 1948, Vol. 21, No. 4, pp. 100–107.) A detailed explanation of the phantastron circuit and its ability to provide precision microsecond time delays which vary linearly with control voltage. Linearity can be within $\pm 0.1\%$ of the maximum delay provided that this is not too low. The choice of suitable anode and cathode resistors and capacitors is discussed. The control potentiometer must have a high order of accuracy and should take its voltage from a divider chain across the phantastron supply.

With careful layout and choice of components, a change of calibration within 0.5% has been obtained over the temperature range $-50°C$ to $+70°C$. Recalibration is advised after every 20 to 50 hours' use; the aging of valves caused considerable long-period changes.

A method of obtaining longer delays of very high precision is given, together with a brief outline of control circuits and automatic tracking methods.

621.392.5 : 534.321.9 **2479**

Ultrasonic Delay Lines: Parts 1 & 2.—H. B. Huntington, A. G. Emslie & V. W. Hughes; A. G. Emslie, H. B. Huntington, H. Shapiro & A. E. Benfield. (*J. Franklin Inst.*, Jan. & Feb. 1948, Vol. 245, Nos. 1 & 2, pp. 1–24 & 101–115.) Part 1: Theoretical considerations involved in the general process of ultrasonic propagation are examined in detail. The fundamental action of the piezoelectric transducer operating in the thickness mode of vibration, loss through mismatch, and the behaviour of the circuit at resonance are investigated. Wave propagation in the transmitting medium and attenuation due to absorption and diffraction spreading of the beam are discussed. Part 2: Discussion of the experimental aspects of the development and construction of ultrasonic delay lines in liquid media. Excellent reproduction of pulse shape is claimed for the lines, which may be of the broad-band type. They have proved satisfactory for delay times of the order of 3 ms or less.

Means of eliminating secondary signals caused by multiple reflections are indicated. Design considerations are illustrated by actual examples.

621.395.667 **2480**

Design of Shunt Equalizers.—H. N. Wroe. (*Wireless Engr*, June 1948, Vol. 25, No. 297, pp. 192–196.) A precision method is described, and examples of results obtained by using it are given. See also 3560 of 1946.

621.396.611.1 : 512.942 **2481**

Solid Diagrams illustrating Resonance Phenomena.—W. A. Prowse. (*Proc. phys. Soc.*, 1st Feb. 1948, Vol. 60, No. 338, pp. 132–135.) "Three dimensional vector loci are used to express the properties of resonant circuits and of the tuned transformer. An indication is given of the application of the method to other problems, including a simple low frequency selector circuit."

621.396.611.4 **2482**

Perturbation Method applied to the Study of Electromagnetic Cavities.—T. Kahan. (*C. R. Acad. Sci., Paris*, 5th Nov. 1945, Vol. 221, No. 19, pp. 536–538.)

621.396.611.4 : 537.291 **2483**

Effect of an Electron Beam on the Natural Frequencies of a Cavity Resonator.—T. Kahan. (*C. R. Acad. Sci., Paris*, 19th Nov. 1945, Vol. 221, No. 21, pp. 616–618.) Formulae are derived for the change of frequency due to passage of the beam used for excitation.

621.396.615 **2484**

A Novel Oscillator.—J. C. Mouzon. (*Rev. sci. Instrum.*, Feb. 1948, Vol. 19, No. 2, pp. 76–78.) The interelectrode coupling between anode and cathode in this triode oscillator is minimized by using a grounded grid. The inductive feedback is confined more readily to the external circuit than is possible with conventional triode oscillators. A small movement ($\sim$ 0.002 inch) of a metal vane between the coupled anode and cathode coils can be detected; such a system can therefore be applied to industrial control circuits.

621.396.615 **2485**

The Transitron Oscillator.—H. de L. Banting. (*Short Wave Mag.*, June 1947, Vol. 5, No. 4, pp. 220–223.) Theory is briefly outlined. Practical circuit details are given for both LC and RC types. The oscillator is very stable, being independent of changes in valve characteristics; the output voltage is easily controlled without affecting the frequency of oscillation.

621.396.615 : 621.385.832 **2486**

Variable-Frequency Two-Phase Sine-Wave Generator.—T. H. Clark & V. F. Cliffold. (*Elect. Commun.*, Sept. 1947, Vol. 24, No. 3, pp. 382–390.) A method is described for the production of circles on c.r. tube screens. Voltages of equal amplitude and orthogonal phase are generated at frequencies up to 60 c/s by mechanical rotation of metal probes against a flat resistive sheet carrying a current. Details are given of mechanical construction and materials for the resistive sheet, probes and commutator, and a suitable amplifier circuit is described.

621.396.615.17 **2487**

On the Study of Multivibrators using Two Triode Valves.—J. Queffelec. (*C. R. Acad. Sci., Paris*, 19th Nov. 1945, Vol. 221, No. 21, pp. 619–620.) Theory based on consideration of the anode currents of the two valves.

621.396.615.17 : 621.317.755 : 621.396.96 **2488**

A Precision Time-Base and Amplifier developed for Radar Range Measurement.—J. H. Piddington & L. U. Hibbard. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 10, pp. 1602–1610.) The timebase was developed for use in an Australian fire-control radar set. It has an accuracy of about 1 part in 2 000. Brief details of three simplified versions for use in other types of radar sets and having accuracies of the order of 0.5% are also given.

621.396.619.23 **2489**

Wide Deviation Reactance Modulator.—H. D. Helfrich, Jr. (*Electronics*, April 1948, Vol. 21, No. 4, pp. 120–121.) The principles and design procedure are described for obtaining the maximum deviation from an electronic reactance frequency modulator. Details are given of a typical test oscillator and of a universal design chart.

621.396.645 **2490**

Common-Cathode Amplifiers.—N. R. Campbell, V. J. Francis & E. G. James. (*Wireless Engr*, June 1948, Vol. 25, No. 297, pp. 180–192.) The results noted in 1191 and 1471 of 1946 are applied to the mathematical discussion of the optimum adjustment and performance of these amplifiers at about 50 Mc/s.

The most important characteristics are the noise factor N, the input conductance G_i and the effective bandwidth. Optimum adjustment is assumed to be that which gives minimum N for a prescribed ratio of the minimum to maximum gain within a band defined by an ideal filter, regardless of G_i and the absolute gain Γ. The modifications necessary when G_i and Γ are important are discussed.

At 50 Mc/s, transit-time effects, which are discussed in 2420 of August, can be neglected, but electrode-lead inductance effects cannot. Electrode-lead inductances are here assumed small and their effect on optimum adjustment is calculated. The practical implications of this effect are discussed.

The relative merits of triodes and pentodes are considered; results for each are tabulated.

621.396.645 **2491**

Stagger-Tuned Amplifier Design.—H. Wallman. (*Electronics,* May 1948, Vol. 21, No. 5, pp. 100–105.) The relative merits of single tuning, synchronous single tuning, stagger-tuned coupling, and overstaggered circuits are considered in detail. The limits to overall bandwidth of cascaded stages and the transient response characteristics of stagger-tuned circuits are discussed and compared with those of other coupled circuits. Design characteristicr are tabulated and shown graphically. A detailed circuit diagram of a particular 4-stage amplifier is included.

621.396.645 : 518.3 **2492**

Pulse Rise Time Response Chart.—A. J. Baracket. (*Tele-Tech,* Feb. 1948, Vol. 7, No. 2, pp. 38–39.) An aid to the design of video amplifiers to meet h.f. response and rise-time requirements.

621.396.645 : 518.3 **2493**

Exact Design and Analysis of Double- and Triple-Tuned Band-Pass Amplifiers.—M. Dishal. (*Elect. Commun.,* Sept. 1947, Vol. 24, No. 3, pp. 349–373.) Reprint of 3065 of 1947. Several corrections are made.

621.396.645 : [621.317.725 + 535.247.4 **2494**

Bridge-Balanced Amplifiers.—Y. P. Yu. (*Electronics,* May 1948, Vol. 21, No. 5, pp. 111–113.) The errors in zero reading of valve voltmeters due to variations of circuit elements, supply voltages and valve constants may be greatly reduced by means of balancing circuits. Coupling between stages in multistage d.c. amplifiers for sensitive valve voltmeters requires careful design. The use of a cold-cathode voltage regulator, a separate bias supply or a push-pull phase inverting circuit is recommended. A negative-feedback circuit for measuring very small illumination is also described.

621.396.645.012 **2495**

Voltage Amplification Formulas.—H. J. Peake. (*Tele-Tech,* Feb. 1948, Vol. 7, No. 2, p. 48.) The circuit diagram and gain formula are tabulated for a number of triode and pentode amplifier arrangements.

621.396.645.371 **2496**

A Flat-Response Single-Tuned I.F. Amplifier.—E. H. B. Bartelink, J. Kahnke & R. L. Watters. (*Proc. Inst. Radio Engrs, W. & E.,* April 1948, Vol. 36, No. 4, pp. 474–478.) The amplifier provides double-tuned response using single-tuned circuits with negative feedback. The case where relatively narrow pass bands are required is fully discussed.

621.396.662 **2497**

Polarity Response from Tuning-Eye Tubes.—M. L. Greenough. (*Electronics,* April 1948, Vol. 21, No. 4, pp. 162..168.) A circuit is given which enables a standard tuning indicator to be used as a polarity indicator. A standing bias is applied to the valve and the grid is switched either to earth or to the signal, by means of a diode shunt network controlled from the a.c. supply.

621.396.662.21 : 621.385.832 **2498**

Iron-Cored Deflecting Coils for Cathode-Ray Tubes.—A. Woroncow. (*J. Instn elect. Engrs,* Part IIIA, 1946, Vol. 93, No. 10, pp. 1564–1574.) A concise theory of the magnetic circuits of deflecting coils with iron cores is given, and experimental results with various types of single-field and crossed-field coils are described. The properties of sensitivity, inductance, resistance, defocusing and distortion are considered, particular attention being paid to coils with slotted cores.

621.396.662.3 **2499**

Band-, High- and Low-Pass Filters with Level Wave Resistance.—W. Herzog. (*Arch. elekt. Übertragung,* Nov./Dec. 1947, Vol. 1, Nos. 5/6, pp. 184–194.) Design procedure and formulae for bridge-type filters with wave-resistance characteristics equal to those of Zobel half-section filters.

621.396.662.3 : 534.851 : 621.395.813 **2500**

Filter Characteristics for the Dynamic Noise Suppressor.—McCracken. (*See* 2436.)

621.396.665 : 621.396.645.371 **2501**

Automatic Volume Control as a Feedback Problem.—B. M. Oliver. (*Proc. Inst. Radio Engrs, W. & E.,* April 1948, Vol. 36, No. 4, pp. 466–473.) Feedback amplifier theory can be applied to the usual amplified and delayed a.v.c. system. Expressions are derived for the gain of the feedback path (loop gain) in terms of the design requirements and the gain-control characteristic of the controlled amplifier. The reduction of modulation-depth at l.f. due to a.v.c. is considered, and a Nyquist diagram for a stable a.v.c. system is given. Non-delayed a.v.c. is regarded as a particular example of the delayed case.

621.396.813 : 621.317.3 **2502**

An Analysis of the Intermodulation Method of Distortion Measurement.—Warren & Hewlett. (*See* 2553.)

621.396.615 : 621.316.726.078.3 **2503**

Über Synchronisierung von Röhrengeneratoren durch Modulierte Signale. [Book Review]—F. Diemer. Gebr. Leemann & Co., Zürich, 98 pp., 10.80 Swiss francs. (*Wireless Engr,* June 1948, Vol. 25, No. 297, p. 197.) A doctorate thesis. The externally-applied synchronizing voltage is assumed to be modulated either in amplitude or frequency. The first 52 pages contain a mathematical investigation and the rest describe experimental verification of the results.

GENERAL PHYSICS

53.081 **2504**

Units, Dimensions, and Law of Similitude.—L. S. Dzung & A. Meldahl. (*Brown Boveri Rev.,* June/July 1946, Vol. 33, Nos. 6/7, pp. 123–128.) The arbitrary nature and complete independence of the fundamental units of length, area, force, mass, etc. are stressed. Every derived unit is based on a natural law; for example, a square yard is derived from the law that the area of a rectangle is proportional to length × breadth. Any number of units may be regarded as fundamental, but the natural laws involving the fundamental units will lead to equations containing proportionality factors which are not dimensionless, whatever their numerical value. It is convenient to make as many of these proportionality factors numerically equal to unity as possible. We thus prefer to measure area in square yards rather than acres. For Newton's second law of motion it would be most convenient to take a new unit of length equal to 9.81 m. No serious attempt has been made to adjust the unit of temperature so that the universal gas constant becomes unity. The generalization of physical laws by expressing them in terms of dimensionless 'characteristic numbers' is considered. A system of units could be built up in which the gravitational constant, the velocity of light, and Planck's universal constant were all numerically unity, in addition to the more familiar conversion factors already considered. Such a system would contain no arbitrary units and dimensional analysis would be impossible. For terrestrial experiments, however, it is more convenient to ignore the numerical values of these three extraterrestrial constants and have instead three independent fundamental units from which all others are derived. See also 1006 and 1007 of April and back references.

530.12 : 531.18 : 621.396.11 **2505**

The Formulae for the Doppler Effect in the Ellipsoidal Theory of Special Relativity (Error of Einstein's Formulae).—Dreyfus-Graf. (*See* 2591.)

537.525 : 538.551.25 **2506**

Plasma-Electron Oscillations.—E. B. Armstrong. (*Nature, Lond.*, 22nd Nov. 1947, Vol. 160, No. 4073, p. 713.) H.f. oscillations in low-pressure gas discharge tubes are probably plasma-electron oscillations with frequency $\simeq 10^4 n^{\frac{1}{2}}$ where n is the electron concentration. λ can be as short as 5 cm or less. The amplitude of oscillations which can be determined by a probe depends considerably on the position of the probe, but λ changes little as the probe is moved. Sometimes different frequencies are obtained in different parts of the tube. Effects of magnetic fields on oscillation intensity and the mechanism maintaining the oscillations are considered.

538.114 : 621.318.323.2 **2507**

Theory of Alternating Current Auxiliary Magnetization of Ferromagnetic Cores.—R. Risch. (*Brown Boveri Rev.*, June/July 1946, Vol. 33, Nos. 6/7, pp. 129–133.) The advantages of auxiliary magnetization lie in the higher permeability attained and the consequent reduction of core cross-section, ratio error and phase difference.

When the effective and auxiliary magnetization are in phase, the effective permeability equals the differential permeability dB/dH corresponding to the auxiliary field strength.

When the currents are 90° out of phase the effective permeability equals the total permeability B/H corresponding to the auxiliary field strength.

For any intermediate phase difference the effective permeability has intermediate values. Formulae are given involving the differential and total permeabilities and either the phase angle between the fields or that between the fluxes.

The theory is checked by experiment.

2508

546.212 + 546.212.02] : [621.317.3.011.5 + 537.226.2

The Dielectric Properties of Water and Heavy Water.—C. H. Collie, J. B. Hasted & D. M. Ritson. (*Proc. phys. Soc.*, 1st Feb. 1948, Vol. 60, No. 338, pp. 145–160.) A description of several methods of measuring the dielectric constant and loss angle for λ 10 cm, 3 cm, and 1.25 cm. The results are interpreted in terms of the Debye equations with a single relaxation time; the values derived suggest that the molecular reorientation mechanism is the same as that of viscosity. The value of 5.5 found for the optical dielectric constant gives a reasonable result for the dielectric constant of water on the Onsager theory. See also 79 of January.

537.312.62 **2509**

Theorie der Supraleitung. [Book Review]—M. von Laue. Springer-Verlag, Berlin & Göttingen, 1947, 124 pp., 12 RM. (*Nature, Lond.*, 10th Jan. 1948, Vol. 161, No. 4080, p. 37.) An account of the superconduction theory of F. & H. London (*Proc. roy. Soc. A*, 1935, Vol. 149, p. 71; *Physica*, 1935, Vol. 4, p. 341). "The book is written in a very thorough manner; all theoretical results are derived in detail and difficulties are indicated and discussed."

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.16 : 621.396.822 **2510**

Frequency Variation of the Intensity of Cosmic Radio Noise.—J. W. Herbstreit & J. R. Johler. (*Nature, Lond.*, 3rd April 1948, Vol. 161, No. 4092, pp. 515–516.) Discussion of measurements made by the National Bureau of Standards of cosmic noise at 25 and 110 Mc/s. Horizontal $\lambda/2$ dipoles placed $\lambda/4$ above ground were used at both frequencies. The incident noise appears to be proportional to $f^{-0,41}$, f being the frequency. It was also noted that several short-time bursts of very strong noise radiation occurred at times when sudden ionosphere disturbances were reported.

523.53 "1947.08" **2511**

Combined Radar, Photographic and Visual Observations of the Perseid Meteor Shower of 1947.—P. M. Millman, D. W. R. McKinley & M. S. Burland : A. C. B. Lovell. (*Nature, Lond.*, 21st Feb. 1948, Vol. 161, No. 4086, pp. 278–280.) Data obtained in Canada indicate that the strong, enduring radar reflection from meteors is not restricted to the neighbourhood of the point where the meteor is travelling perpendicular to the line of sight. The change in range corresponds consistently with reflection from a meteor path-length of about 20 km. It is suggested that two different mechanisms may be concerned in the production of the effective radar targets. Lovell directs attention to the effects with different wavelengths and to the aspect sensitivity of radar methods of observation. See also 2086 of 1947 and 411 of February (Hey & Stewart).

523.72.029.62 : 523.75 : 621.396.822 **2512**

Solar Radio-Frequency Noise Fluctuations and Chromospheric Flares.—S. E. Williams. (*Nature, Lond.*, 22nd Nov. 1947, Vol. 160, No. 4073, pp. 708–709.) Comparison of times of solar flares with observations of noise on 75 Mc/s showed frequent instances of bursts of noise occurring up to 30 minutes after the observation of a flare. Plasma oscillations high up in the corona from which the noise originates are thought to be excited by corpuscular emission from the flare rather than by ultra-violet radiation.

523.72.029.64 : 621.396.822 **2513**

Solar Noise Observations on 10.7 Centimeters.—A. E. Covington. (*Proc. Inst. Radio Engrs, W. & E.*, April 1948, Vol. 36, No. 4, pp. 454–457.) "Daily observations of the 10.7-cm solar radiation show a 27-day recurrent peak which has a strong correlation with the appearance of sunspots. In the absence of large spots the equivalent temperature of the sun is 7.9×10^4°K. Sudden bursts of solar noise show a sharp rise lasting one or two minutes and a gradual decline to pre-storm value or to a somewhat higher value. Average burst duration is ten minutes."

523.854 : 621.396.822 **2514**

Variable Source of Radio Frequency Radiation in the Constellation of Cygnus.—J. G. Bolton & G. J. Stanley. (*Nature, Lond.*, 28th Feb. 1948, Vol. 161, No. 4087, pp. 312–313.) General results of investigations, mainly on 100 Mc/s, give the location and size of the source, which may be effectively a point. The radiation consists of two components, one constant except for a shallow intensity peak at 100 Mc/s, and the other showing considerable variation. The periodicity of the variable component decreases with decreasing frequency, while its intensity increases rapidly. No variable component has yet been detected on 200 Mc/s.

523.854 : 621.396.822.029.62 **2515**

Measurement of Galactic Noise at 60 Mc/s.—K. F. Sander. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 10, pp. 1487–1489.) The noise, measured for different bearings and times of day, is expressed quantitatively by the equivalent temperature of the aerial radiation resistance. Temperatures between 1 800 and 10 000° K have been observed.

538.711(24.08) **2516**

Variation of Geomagnetic Intensity with Depth.—S. Chapman : S. K. Runcorn. (*Nature, Lond.*, 10th Jan. 1948, Vol. 161, No. 4080, p. 52.) The formula for the variation of the earth's magnetic field with depth, derived by Runcorn from Blackett's theory (3112 of 1947) and quoted by Hales & Gough (1635 of June), is shown by Chapman to be inconsistent with the formula derived from any 'core' theory. A correct formula is given which is derivable from a vector potential.

Runcorn points out that his formula contains an approximation which accounts for the above inconsistency ; Chapman's more general formula is acknowledged.

550.38 **2517**

Tentative Theory of the Origin of the Earth's Magnetic Field.—A. Delaygue. (*Ann. Géophys.*, March 1945, Vol. 1, No. 2, pp. 121–143.) It is suggested that within the earth free positive ions exist whose mass m and valency z are such that $m/z = 3.14 \times 10^{-6}$ c.g.s. units. These ions are surrounded by a homogeneous mass of fixed particles, among which are negative ions which exactly neutralize the positive ions. This hypothesis can explain not only the principal part of the earth's magnetic field, but also the existence of a dense positively-charged metallic nucleus surrounded by a less dense negatively-charged layer. The mass of the nucleus is about 3×10^{27} gm and its total charge 4×10^{23} e.s. units. The theory does not seem able to explain the inclination of the earth's magnetic axis to its geographical axis, nor the secular variations of the earth's field which have their origin within the earth.

551.510.52 : 621.396.11 **2518**

Continuous Tropospheric Soundings by Radar.—Friend. (*See* 2593.)

551.510.535 : 551.594.6 **2519**

The Fine Structure of Atmospherics. Contribution to the Study of the Ionosphere.—R. Rivault. (*C. R. Acad. Sci., Paris*, 5th Nov. 1945, Vol. 221, No. 19, pp. 540–542.) Conclusions derived from the analysis of more than 6,000 oscillograms are presented. For further conclusions see 2521 below. The oscillograms can be classed in 5 well-defined types.

Type 1 is characterized by a large number of peaks with separations of 35–80 μs and with exponential damping either regular or variable by steps. The total duration varies within wide limits, from about 100 μs to many milliseconds. This type is more frequent in summer than winter and is attributed to the leader stroke.

Type 2 consists of 3 swings of large amplitude, the two crests of the same sign being separated by 35–75 μs, most frequently by about 50 μs. This type in its sharpest form is recorded during local storms and is attributed to the return stroke. The sharpness and short duration of these atmospherics permit analysis of the multiple reflections they undergo between the earth and the ionosphere. Under favourable conditions multiple echoes are recorded on the oscillograms ; the atmospherics are then of type 4, and the height of the reflecting layer can be found from a single oscillogram, together with the distance of the storm centre. Records obtained during 1941–1945 give heights of 75–90 km, so that the lower part of the E region is responsible for the reflection of atmospherics whose maximum energy lies in the frequency range 5–50 kc/s. The number of well-defined echoes may vary from half a dozen for a storm centre 300–500 km distant, to about 30 for distances of 1 000–1 800 km. Atmospherics of types 1 and 2, or 1 and 4, are frequently found on the same oscillogram.

Type 3 consists of a train of sinusoidal damped oscillations with a pseudo-period of the successive alternations increasing from about 70 to 225 μs, the crest of greatest amplitude being the second or third. This is a winter type and appears to come from centres as far away as 2 000 km. An explanation of this type has been given by Haubert (2520 below).

Type 5 has sometimes the characteristics of type 3 and sometimes of type 4. The peaks representing successive echoes are often sharp, but their separation tends towards 250–300 μs and their damping is much less rapid than with type 3. Type 5 is thought to be a transition type occurring at the end of stormy periods; it indicates that the reflecting layer concerned is not parallel to the ground and has a height of the order of 40 km.

551.510.535 : 551.594.6 **2520**

Contribution to the Study of the Fine Structure of Atmospherics.—A. Haubert. (*C. R. Acad. Sci., Paris*, 5th Nov. 1945, Vol. 221, No. 19, pp. 543–545.) Certain types of atmospherics are explained by the occurrence of multiple reflections of an initial pulse between the ground and an ionosphere layer with an effective height of 75–90 km. The properties of the atmospherics consisting of a train of sinusoidal damped oscillations, called type 3 by Rivault (2519 above), can be explained by the assumption of guided propagation of the initial oscillation between the earth and an ionosphere layer at a height of about 50 km. The critical frequency of such a waveguide is of the right order of magnitude.

551.510.535 : 551.594.6 **2521**

Origin of Certain Types of Atmospherics.—R. Rivault. (*C. R. Acad. Sci., Paris*, 19th April 1948, Vol. 226, No. 16, pp. 1300–1302.) Recording of the waveform of atmospherics (2519 above) gives information, in the case of type 4, of the distance of the originating flash, whose location is complete if a c.r. goniometer is used to indicate direction. Such indication is only given roughly for distances less than about 500 km, but by using two goniometers separated by some hundreds of kilometres, location is effected much more accurately. Experiments with goniometers at Poitiers and Bagneux are described, with particular reference to atmospherics of type 3, trains of sinusoidal damped waves, and type 4. The results show that during September and October, 1947, the sources of atmospherics were near the shores of the Mediterranean and that when depressions filled up and storms abated, the type-4 atmospherics were modified, the echoes broadening, the peaks being rounded off and decreasing rapidly, approximating to types 3 and 5 and making telemetry less easy. This change of type of the atmospherics appears to indicate a physical modification of the electric discharges towards the end of stormy periods.

551.510.535(54) : 550.38 **2522**

Abnormalities in the F-Region of the Ionosphere at Calcutta.—S. S. Baral, S. N. Ghosh & M. Debray. (*Nature, Lond.*, 3rd Jan. 1948, Vol. 161, No. 4079, p. 24.) Critical frequency observations for the F-region at Calcutta and Madras during January 1947 show that maximum ionization density is maintained for several hours after sunset. This phenomenon does not occur at Delhi. Delhi and Calcutta have nearly the same latitude but the magnetic-dip values differ by a relatively large amount.

This difference in ionization variation at Calcutta and Delhi may be due to a geomagnetic control of the ionosphere ; such control was first suggested by Appleton (2898 of 1946).

551.593.9 **2523**

The Spectrum of the Night Sky in the Blue and Violet Regions.—J. Cabannes & J. Dufay. (*Ann. Géophys.*, August 1944, Vol. 1, No. 1, pp. 1–17.) Details of apparatus and method, with a list of 70 lines from 3 834 to 5 160 Å.

LOCATION AND AIDS TO NAVIGATION

621.396.9 **2524**

1948 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs, W. & E.*, March 1948, Vol. 36, No. 3, pp. 365–380.) Abstracts are given of the following papers read at the Convention :—Basic Principles of Doppler Radar, by E. J. Barlow. The Radiovisor Landing System for Aircraft, by D. G. Shearer & W. W. Brockway. Considerations in the Design of a Universal Beacon System, by L. B. Hallman, Jr. Surveillance Radar Deficiencies and how they can be Overcome, by J. W. Leas. The Course-Line Computer, by F. J. Gross. Aircraft Instrumentation and Control, by F. L. Moseley, J. A. Biggs, E. T. Heald & J. C. McElroy. New Techniques in Quantitative Radar Analysis of Rainstorms, by D. Atlas. An Automatic-Tracking Direction-Finder Receiving System for Meteorological Use, by W. Todd. Titles of other papers are given in other sections.

621.396.93 + 621.396.65 + 621.396.75 **2525**

Angola Radio Network.—Pelaez. (*See* 2628.)

621.396.93 **2526**

Instant-Reading Direction Finder.—P. C. Hansel. (*Electronics*, April 1948, Vol. 21, No. 4, pp. 86–91.) Four omnidirectional vertical collectors are equally spaced round a horizontal circle. Their outputs are independently modulated in balanced modulators, the signals from alternate aerials being modulated in quadrature. The resulting carrier-suppressed signals are then combined in a common impedance, the angle of arrival being a function of the phase of the l.f. envelope. Direction is indicated on a c.r. tube phase-meter. Sense can be determined visually by means of a single switch. Provision is made for splitting the directivity-pattern in the case of weak signals, to give better resolution. Several receivers can use the aerials at the same time.

621.396.93 : 551.594.6 **2527**

Direction Finder for Locating Storms.—W. J. Kessler & H. L. Knowles. (*Electronics*, May 1948, Vol. 21, No. 5, pp. 106–110.) Two perpendicular loop aerials feed the vertical and horizontal deflecting plates of a c.r. tube through separate amplifiers. The bearing of lightning flashes is thus indicated directly.

621.396.93 : 621.396.677.029.58 **2528**

H-Type Adcock Direction Finders.—W. Ross & R. E. Burgess. (*Wireless Engr*, June 1948, Vol. 25, No. 297, pp. 168–179.) The results of specific experiments are combined with the general experience gained in several years' work with these h.f. direction finders (3–30 Mc/s) in this survey of the important factors in their design. The main conclusions are : (*a*) For maximum sensitivity, the ratio of aerial capacitance to total parallel aerial-circuit capacitance, and the dipole effective length, must both be as large as possible ; the dipoles should therefore be end-loaded. (*b*) Coupling circuits between the aerials and the first valve of the receiver must be such as to ensure (i) a high coefficient of coupling in all transformers and goniometers, (ii) as few intermediate circuits as possible, (iii) resonance of the primary inductance of the aerial transformers (or goniometer field coils) with the total aerial-circuit capacitance just outside the h.f. end of each frequency band, (iv) coverage of the total working-frequency range in a series of sub-ranges each of the order 1.5 : 1 in frequency. (*c*) Aerial-circuit balancing becomes extremely critical near the fundamental resonant frequency of the central column formed by the down leads and/or supporting column. (*d*) The presence of an operator can cause serious bearing errors in small rotating-aerial systems, whatever his position, especially when the bearings are flat. (*e*) The image in the ground of the horizontal conductor formed by the feeder lines gives rise to an inherent polarization error which is only important when aerial height is small compared to aerial spacing. (*f*) The presence of the receiver box between or near the lower halves of the dipoles can cause polarization error. (*g*) Other sources of polarization error exist which are as yet unexplained.

621.396.933 **2529**

Simultaneous Radio Range and Radiotelephone Equipment.—Royden. (*See* 2634.)

621.396.96 **2530**

SCR-545-A — a Completely Automatic Tracking Radar.—C. R. Taft. (*Bell Lab. Rec.*, Oct. 1947, Vol. 25, No. 10, pp. 378–382.) At long ranges (up to about 46 miles) a 205-Mc/s manually-operated target 'acquisition' system uses 200-kW pulses. At short ranges (less than 23 miles) a 2 800-Mc/s tracking system with 350-kW pulses can also be used. The two aerial systems are mounted together ; the 2 800-Mc/s aerial is a parabolic reflector with a sharp beam which is made to describe a conical path. A target on the axis of the cone will return a constant signal during scanning : the variations in signal strength from other targets are used to swing the tracking aerial towards the target. A gate circuit, which opens just before and closes just after the signal pulse returns from the target, is used to determine range to within ± 5 yards. A second gate circuit splits the signal pulse into two parts which are compared ; the circuit is shifted automatically towards the larger part until both are equal, when the range tracking is 'on target'. The whole system is mounted on vehicles and can be set up in less than ½ hr by 10 men.

621.396.96 : 621.396.615.17 : 621.317.755 **2531**

A Precision Time-Base and Amplifier developed for Radar Range Measurement.—Piddington & Hibbard. (*See* 2488.)

621.396.96 : 621.396.82 **2532**

Naval Radar Anti-Jamming Technique.—R. V. Alred. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 10, pp. 1593–1601.) Specimen photographs are shown of the appearance of various types of jamming signal. Circuits for neutralizing specific types of jamming and for reducing its overall effect are discussed.

621.396.96 **2533**

Fundamentals of Radar. [Book Notice]—S. A. Knight. Pitman & Sons, London, 128 pp., 10s. (*Wireless Engr*, June 1948, Vol. 25, No. 297, p. 197.)

MATERIALS AND SUBSIDIARY TECHNIQUES

533.5 **2534**

High Vacuum Pumps, Their History and Development : Parts 2-4.—R. Neumann. (*Electronic Engng*, Feb.–April 1948, Vol. 20, Nos. 240–243, pp. 44–48, 79–83 & 122–125.) Part 2 : Modern developments. Parts 3 & 4 : Diffusion pumps. Part 1 : 1371 of May.

537.228.1 **2535**

Piezoelectric Crystal Culture.—A. C. Walker. (*Bell Lab. Rec.*, Oct. 1947, Vol. 25, No. 10, pp. 357–362.)

The commercial production of ammonium dihydrogen phosphate (ADP) crystals is described. Z-cut plates are used as seeds in a system of rocking tanks housed in a temperature-controlled room. An experimental apparatus using a reciprocating rotary seed holder is also described. Details are given of crystal growth and of conditions which can cause undesirable formations. See also 739 of March.

546.212 + 546.212.02] : [621.317.3.011.5 + 537.226.2 **2536**
The Dielectric Properties of Water and Heavy Water.—Collie, Hasted & Ritson. (*See* 2508.)

546.28 : 621.314.632 **2537**
A Silicon-Metal Contact Resistance.—E. H. Putley. (*Nature, Lond.*, 22nd Nov. 1947, Vol. 160, No. 4073, pp. 710–711.) The resistance between a piece of silicon crystal and the cup in which it was soldered in a commercial rectifier Type CV253 was found to be about 1 Ω. A slight rectifying action was found in the opposite sense to the tungsten-point contact.

549.514.51 : 537.228.1 **2538**
Calculation of the Piezo-Electric Constants of α- and β-Quartz.—B. D. Saksena. (*Nature, Lond.*, 21st Feb. 1948, Vol. 161, No. 4086, pp. 283–284.) Equations are derived from which calculated values of the constants are obtained in complete agreement with observed values.

621.315 : 621.317.333.4 **2539**
The Properties of High-Voltage Conductors for High-Frequency Transmission and for Fault Location by Radio Methods.—H. Elger. (*Arch. elekt. Übertragung*, Nov./Dec. 1947, Vol. 1, Nos. 5/6, pp. 195–204.) Measurements of wave resistance and attenuation, at frequencies up to 4 000 kc/s, indicate that these properties can be used successfully for fault location not only on h.v. lines, but also on h.f. telephone cables.

621.315.61.011.5 : 546.431.82 : 537.228.1 **2540**
Dielectric Constant and Piezo-Electric Resonance of Barium Titanate Crystals.—B. T. Matthias. (*Nature, Lond.*, 28th Feb. 1948, Vol. 161, No. 4087, pp. 325–326.) The growth of single crystals and the ferroelectric behaviour of their pseudo-cubic modification are discussed. Graphs show the dielectric constant, and the piezoelectric resonance frequency for directions parallel to the three crystallographic axes, as a function of temperature. Dielectric hysteresis effects observed in all three directions disappear above about 100° C. The effect of twinning on the results is considered. See also 125, 126 and 127 of January.

621.315.612 : 621.317.3.011.5.029.64 **2541**
Measurement of High Permittivity Values at Centimetre Wavelengths.—J. G. Powles. (*Nature, Lond.*, 3rd Jan. 1948, Vol. 161, No. 4079, p. 25.) The permittivity ϵ of a ceramic material is measured in the frequency range 8 100–10 000 Mc/s by placing the specimen in an H_{01} waveguide system and measuring the energy transmitted through the material, for constant incident energy, whilst varying the frequency. Experimental results relating transmitted energy and frequency for Zn_2TiO_4 and rutile (TiO_2) show a close agreement with the theoretical curves, using an assumed permittivity value. The peaks obtained in these curves are used to evaluate the accurate permittivity of the material, since it can be shown that peak separation/peak width $\approx \sqrt{\epsilon}$ for large values of ϵ. It is also demonstrated that the behaviour of the materials approaches that of metals as the value of the permittivity increases.

621.315.616 **2542**
Synthetic Hard Rubber.—W. S. Bishop. (*Bell Lab. Rec.*, Feb. 1948, Vol. 26, No. 2, pp. 55–57.) Production methods are outlined. Physical properties are not greatly inferior to those of natural rubber products, except as regards machining qualities and brittleness.

621.318.24 **2543**
A Thyratron Controlled Half-Cycle Magnetizer.—E. W. Hutton. (*Electronic Industr.*, Feb. 1948, Vol. 2, No. 2, pp. 8–10.) Intricately shaped magnets are magnetized by threading a conductor through the window of the magnetic circuit and passing sufficient d.c. to produce the required field. By using single d.c. pulses obtained by rectification of a suitably amplified a.c. supply the requisite conditions are readily obtained. A basic control circuit is given.

621.357 : 679.5 **2544**
Plating Plastics.—H. Narcus. (*Metal Ind., Lond.*, 13th Feb. 1948, Vol. 72, No. 7, pp. 128–129.) A Cu-reduction process for depositing films on nonconductors prior to the electro-deposition of an intermediate coating of Cu or Ag. The advantages of the method as compared with silvering processes are enumerated.

621.775.7 : 05 **2545**
Abstracts on Powder Metallurgy.—(*Nature, Lond.*, 22nd Nov. 1947, Vol. 160, No. 4073, p. 705.) A new 16-page monthly abstract journal, *Metal Powder Report*, dealing solely with the production, treatment and use of metal powders, edited by W. D. Jones & R. A. Hetzig. It can be obtained from Powder Metallurgy Ltd, Commonwealth House, 1–19 New Oxford St., London, W.C.1, for an annual subscription of £3.7.6.

631.437 + 546.212] : 621.3.011.5.029.64 **2546**
Electrical Properties of Soil and Water at Centimetre Wave-Lengths.—(*Nature, Lond.*, 10th Jan. 1948, Vol. 161, No. 4080, p. 73.) British work in this field is reviewed and some recent results obtained in America for dry soil and for pure and salt water are discussed and compared with results obtained in Britain. Values obtained for the different soils vary considerably, but the results for water show fairly good agreement with values predicted theoretically from work done in Britain at higher frequencies.

669 **2547**
1948 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs, W. & E.*, March 1948, Vol. 36, No. 3, pp. 365–380.) Abstracts are given of the following papers read at the Convention:—ASTM Committee Work—Factory Tests on Cathode Nickel, by J. T. Acker. A Standard Diode for Radio-Tube-Cathode Core-Material Approval Tests, by R. L. McCormack. Titles of other papers are given in other sections.

MATHEMATICS

518.5 **2548**
1948 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs, W. & E.*, March 1948, Vol. 36, No. 3, pp. 365–380.) Abstracts are given of the following papers read at the Convention:—Large-Scale Computers, by R. L. Snyder. The Univac, by J. W. Mauchly. Engineering Design of a Large-Scale Digital Computer, by J. R. Weiner, C. F. West & J. E. DeTurk. Selective Alteration of Digital Data in a Magnetic Drum Computer Memory, by A. A. Cohen & W. R. Keye. Titles of other papers are given in other sections.

518.5 **2549**
Elements of D.C. Analog Computers.—G. A. Korn. (*Electronics*, April 1948, Vol. 21, No. 4, pp. 122–127.) Discussion of: (*a*) the design of simple circuits for adding, multiplying, integrating and differentiating, (*b*) operating principles, (*c*) limits of accuracy, (*d*) applications.

518.5 **2550**

Selective Sequence Digital Computer for Science.—(*Electronics*, April 1948, Vol. 21, No. 4, pp. 138, 140.) A development of the Harvard automatic sequence controlled calculator (461, 468 and 787 of 1947) with greatly increased memory and ' programming ' capacity.

518.5 : 517.3 **2551**

Design of D.C. Electronic Integrators.—G. A. Korn. (*Electronics*, May 1948, Vol. 21, No. 5, pp. 124–126.) The basic circuit consists of an integrating RC network in conjunction with a d.c. amplifier. The accuracy of integration is affected by the leakage resistance of the capacitor and by the amplifier gain. The output voltage may be made proportional to the time integral of the input voltage by means of a compensated circuit. The amplifier gain is made positive so that capacitor leakage constitutes regenerative feedback. Degenerative feedback through the integrating capacitor prevents amplifier instability.

MEASUREMENTS AND TEST GEAR

621.317 **2552**

1948 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs, W. & E.*, March 1948, Vol. 36, No. 3, pp. 365–380.) Abstracts are given of the following papers read at the Convention :—[Measurement of] Current Distributions on Aircraft Structures, by J. V. N. Granger. Visual Analysis of Audio-Frequency Transient Phenomena, by D. E. Maxwell. Square-Wave Analysis of Compensated Amplifiers, by P. M. Seal. A Picture-Modulated R.F. Generator for Television Receiver Measurements, by A. Easton. Swept-Frequency 3-Centimeter Impedance Indicator, by H. J. Riblet. An Automatic V.H.F. Standing-Wave-Ratio Plotting Device, by W. A. Fails, L. L. Mason & K. S. Packard. Microwave Impedance Bridge, by M. Chodorow, E. L. Ginzton & J. F. Kane. Impedance Measurements by means of Directional Couplers and Supplementary Voltage Probe, by B. Parzen. A Waveguide Bridge for measuring Gain at 4 000 Mc/s, by A. L. Samuel & C. F. Crandell. Design and Application of a Multipath Transmission Simulator, by H. F. Meyer & A. H. Ross. Frequency Measurement by Sliding Harmonics, by J. K. Clapp. A General-Purpose Oscillograph for Precision Time Measurement, by R. P. Abbenhouse. Some Considerations in Extending the Frequency Range of Radio Noise Meters, by W. J. Bartik & C. J. Fowler. Analysis of a Microwave Absolute Attenuation Standard, by A. B. Giordano. 10-Centimeter Power Measuring Equipment, by T. Miller. Titles of other papers are given in other sections.

621.317.3 : 621.396.813 **2553**

An Analysis of the Intermodulation Method of Distortion Measurement.—W. J. Warren & W. R. Hewlett. (*Proc. Inst. Radio Engrs, W. & E.*, April 1948, Vol. 36, No. 4, pp. 457–466.) Nonlinearity in a network (assumed independent of frequency) produces harmonic and intermodulation products which have a fixed relationship; either may be used to assess the degree of nonlinearity. The relationship is analysed and shown graphically for transfer characteristics (*a*) readily representable by a power series, (*b*) having an abrupt slope change, and (*c*) representable by a portion of a sine wave. The analysis is verified by experiment. Simple equations and tables are given for predicting intermodulation products from points on the transfer characteristic.

621.317.3.011.5 : 621.319.4 **2554**

Capacitor for the Measurement of the Dielectric Constant of a Liquid.—J. Benoit & L. Fouquet. (*C. R. Acad. Sci., Paris*, 19th Nov. 1945, Vol. 221, No. 21, pp. 614–616.) Invar and quartz are used to eliminate temperature effects and the special cylindrical construction avoids the use, during measurements, of any portions where the field is not radial.

621.317.311 : 621.317.755 **2555**

Visual Measurements of Short Pulses of Direct Current.—P. F. Ordung. (*J. Franklin Inst.*, Jan. 1948, Vol. 245, No. 1, pp. 37–51.) Discussion of techniques and precautions essential to oscillographic observations of short pulses with high repetition rates and with amplitudes which may be greater than 100 A. The determination of the bandwidths required for measurements of such pulses, the construction and calibration of metering resistors and the proper termination of the coaxial transmission lines connecting the metering circuits to the oscillograph are also considered.

621.317.331 : 551.594.13 **2556**

On the Principles of the Measurement of the Ionic Conductivity of the Atmosphere by means of Discharge Apparatus.—L. Cagniard. (*Ann. Géophys.*, August 1944, Vol. 1, No. 1, pp. 25–36.) Discussion shows that the usual construction of Gerdien apparatus has serious defects. Modifications have been introduced in experimental apparatus, which will be described in a later article.

621.317.333.4 : 621.315 **2557**

The Properties of High-Voltage Conductors for High-Frequency Transmission and for Fault Location by Radio Methods.—Elger. (*See* 2539.)

621.317.43 : 621.317.729 **2558**

Magnetic Leakage Evaluated with an Electrolytic Tank.—F. Levi. (*Electronics*, April 1948, Vol. 21, No. 4, pp. 178..186.) A model of the magnetic circuit is immersed in an electrolyte. When suitable voltages are applied to parts of the model, currents are produced which are nearly proportional to the magnetic fluxes.

621.317.7 **2559**

Measurement Apparatus.—B. Fradkin ; B.F. & J.S. (*Radio tech. Dig., Édn franç.*, Feb. & April 1948, Vol. 2, Nos. 1 & 2, pp. 57–64 & 111–117.) Developments in France are compared with developments abroad, particularly in America. The instruments discussed include practically every type of apparatus used in radio measurement and testing.

621.317.725 + 535.247.4] : 621.396.645 **2560**

Bridge-Balanced Amplifiers.—Yu. (*See* 2494.)

621.317.725.027.7 **2561**

High Voltage Measurements.—(*Electrician*, 27th Feb. 1948, Vol. 140, No. 3637, pp. 649–650.) Short summary of I.E.E. paper entitled " Absolute Measurement of High Voltages by Oscillating Electrode Systems", by E. Bradshaw, S. A. Husain, N. Kesavamurthy & K. B. Menon. The paper, largely mathematical, deals mainly with the ellipsoid voltmeter, in which e.s. forces are measured indirectly, by their influence on the period of oscillation of a conducting body of known mass and dimensions. See also 3584 of 1947 (Bruce).

621.317.733 **2562**

A Conductance Unbalance Bridge.—L. E. Herborn. (*Bell Lab. Rec.*, Feb. 1948, Vol. 26, No. 2, pp. 73–76.) Alignment of crystal channel filters (2215 of August) is effected by comparison and subsequent adjustment of the conductance of the various branches. Special design features and the operation of a bridge for measuring the unbalance are described. Differences as small as 00.01 μmho can be detected.

621.317.733 **2563**

R.F. Bridge for Broadcasting Stations.—F. Schumann & C. Duke. (*Electronics*, April 1948, Vol. 21, No. 4, pp. 83–85.) A variable-frequency signal generator, calibrating oscillator, bridge circuit, detector and batteries are incorporated in a single light-weight unit. Construction and operation details are given.

621.317.755 **2564**

General-Purpose Oscilloscope.—J. F. O. Vaughan. (*Wireless World*, May 1948, Vol. 54, No. 5, pp. 160–165.) Detailed instructions are given for the conversion of three Service surplus radar display units into c.r. oscilloscopes for laboratory work.

621.317.755 **2565**

A General-Purpose 5-Inch Cathode-Ray Oscillograph.—S. A. Lott & H. J. Oyston. (*A.W.A. tech. Rev.*, Oct. 1947, Vol. 7, No. 4, pp. 397–405.)

621.317.755 **2566**

High-Frequency Oscilloscopes for Pulses and Other Transients.—W. L. Gaines. (*Bell Lab. Rec.*, Feb. 1948, Vol. 26, No. 2, pp. 68–72.) Review of war-time developments and of principal characteristics. A simple reflector method of providing a virtual scale for the face of the c.r. tube is described.

621.317.755 : 621.397.6 **2567**

Monitoring 'Scope for Television Production Lines.—R. de Cola. (*Tele-Tech*, Feb. 1948, Vol. 7, No. 2, pp. 40–41.) Equipment producing synchronizing, driving and blanking signals, and using a method of trace separation which permits simultaneous observation of two signal channels.

621.317.79 : 621.396.615 **2568**

A Precision Beat-Frequency Oscillator.—S. A. Lott & I. A. Hood. (*A.W.A. tech. Rev.*, Oct. 1947, Vol. 7, No. 4, pp. 385–395.) A portable oscillator of range 0–20 kc/s. It includes a frequency comparator and standard 100-kc/s source for giving spot calibration frequencies at subharmonics of 100 kc/s to within 0.03%.

621.317.79 : 621.396.615.12 **2569**

Beat Frequency Tone Generator with RC Tuning.—J. W. Whitehead. (*Electronics*, May 1948, Vol. 21, No. 5, pp. 130, 146.) The circuit here detailed can cover wide frequency bands with good frequency stability, low distortion, simple frequency control and low coupling with neighbouring components.

621.317.79 : 621.396.615.17 **2570**

A Mechano-Piezoelectric Generator for Pulses and Short Time Intervals.—H. Gerdien & W. Schaaffs. (*Frequenz*, Feb. 1948, Vol. 2, No. 2, pp. 49–52.) An elinvar rod, 1 m long and 2 cm in diameter, has quartz disks about 0.5 cm thick at each end, followed by 20-cm rods of ordinary steel also 2 cm in diameter, the whole being secured by ring clamps with ebonite washers. The ends of the shorter rods are hardened. Impact of a hardened steel ball (carried on a pendulum rod) on one end of the system gives rise to voltage pulses in the two quartz disks. These pulses are separated by the time interval required for the pressure wave, which travels at the speed of sound, to traverse the elinvar rod. This time interval is of the order of 2×10^{-4} sec and the pulse width at the base is about 3×10^{-5} sec. Applications of the device are discussed.

621.317.79 : 621.396.619 **2571**

Frequency and Modulation Monitor for TV and FM.—C. A. Cady. (*Tele-Tech*, Feb. 1948, Vol. 7, No. 2, pp. 44–45.) A pulse-count detection circuit provides indications of centre frequency and percentage modulation, a high-fidelity output for distortion measurements and a 600-Ω output for audio monitoring. Frequency ranges are 30–162 Mc/s and 160–220 Mc/s.

621.317.791 **2572**

Probe Valve-Voltmeter and D.C. Volt-Ammeter.—A. G. L. Foster. (*R.S.G.B. Bull.*, Feb. 1948, Vol. 23, No. 8, pp. 150–153.) Complete circuit details are given of an inexpensive multi-purpose test instrument.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

534.321.9.001.8 : 362.41 **2573**

Blind Guidance by Ultrasonics.—F. H. Slaymaker & W. F. Meeker. (*Electronics*, May 1948, Vol. 21, No. 5, pp. 76–80.) Long summary of 1947 National Electronics Conference paper. A portable device analagous to radar, using pulsed f.m. A single a.f. tone corresponds to any given obstacle distance ; the frequency increases with the distance. Simultaneous echoes from different distances are identified by combinations of individual tones. The equipment operates at 65 kc/s, weighs $5\frac{1}{2}$ lb and will detect obstacles up to 30 ft away.

539.16.08 + 621.3 **2574**

1948 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs, W. & E.*, March 1948, Vol. 36, No. 3, pp. 365–380.) Abstracts are given of the following papers read at the Convention :—Oscillator Design for 130-Inch Frequency-Modulated Cyclotron, by E. M. Williams & H. E. DeBolt. An Electronic Instrument for the Determination of the Deadtime and Recovery Characteristics of Geiger Counters, by L. Costrell. Electronic Classifying, Cataloguing, and Counting Devices, by J. H. Parsons. A Selective Detector for Charged Particles, by K. Boyer. Use of Diode Rectifiers with Adjustable Transformers for Motor Speed Control, by W. N. Tuttle. Spark Oscillators for Electric Welding of Glass, by J. P. Hocker. Coupling Effects between Infrared Radiation and a Supersonic Field, by W. J. Fry & F. J. Fry. Some Considerations in the Design of Precision Telemetering Equipments, by R. Whittle. Megacycle Stepping Counter, by C. B. Leslie. Titles of other papers are given in other sections.

539.16.08 **2575**

Diamonds as Radiation Detectors.—(*Electronic Engng*, March 1948, Vol. 20, No. 241, p. 83.) Extract from National Bureau of Standards report by L. F. Curtiss. " A diamond placed in a strong electric field initiates sharp electrical pulses when gamma radiation is absorbed." Because of its small size, apparent indestructibility and sensitivity comparable with the G-M counter, it may well replace the latter in many applications.

539.16.08 **2576**

Short Time Delays in Geiger Counters.—C. W. Sherwin. (*Rev. sci. Instrum.*, Feb. 1948, Vol. 19, No. 2, pp. 111–115.) Causes include : (*a*) the transit time of the secondary electrons as they move towards the central wire, and (*b*) the time required to form the initial part of the ion sheath.

539.16.08 **2577**

The Properties of Some New Types of Counters.—S. C. Curran & J. M. Reid. (*Rev. sci. Instrum.*, Feb. 1948, Vol. 19, No. 2, pp. 67–75.) An investigation of the effect of variation in geometrical design on performance. Rectangular counters with nonsymmetrical wires, multiple wire counters, and cylindrical cathodes with nonaxial wires are described. The use of such shapes is shown to reduce operating voltages and dead-times. Applications to cosmic ray and γ-ray detection are discussed.

539.16.08 **2578**

Some Experiments with Adjustable Geiger-Müller Counters.—M. Chaudhri & A. G. Fenton. (*Proc. phys. Soc.*, 1st Feb. 1948, Vol. 60, No. 338, pp. 183–193.) A description of special counters in which it is possible to alter the effective length as well as the material and diameter of the anode without opening the counters.

539.16.08 **2579**

Radiation Counter Tubes and Their Operation.—N. Anton. (*Electronic Industr.*, Feb. 1948, Vol. 2, No. 2, pp. 4–7.) Describes the various kinds of radiation measurable by counters. The characteristics of 13 argon-filled tubes are tabulated.

621.316.718 : 621.313.2-9 : 621.385.38 **2580**

New Thyratron Circuit for Motor Control.—J. R. Devoy. (*Electronics*, April 1948, Vol. 21, No. 4, pp. 116–119.) See also 3985 of 1947 (Heumann).

621.316.74 : 621.365 **2581**

Vacuum Furnace Control.—F. F. Davis. (*Electronics*, May 1948, Vol. 21, No. 5, p. 81.) Circuit and operation details of a system to guard against burnout of tungsten heaters due to excessive gas pressure. Thermistors serve as sensing elements.

621.317.39 : 531.717 **2582**

Thickness Gage for Moving Sheets.—J. W. Head. (*Electronics*, May 1948, Vol. 21, No. 5, pp. 90–92.) Thickness of non-magnetic materials between 0.001 and 1.0 inch is measured by passing the sheets between the primary and secondary of a transformer ; variation of thickness changes the coupling and produces unbalance in a bridge circuit, in which a meter gives direct indication of thickness. Circuit and operation details are given.

621.38.001.8 : 786.6 **2583**

Electronic Organ.—T. H. Long. (*Electronics*, May 1948, Vol. 21, No. 5, pp. 117–119.) The instrument comprises 167 grid-circuit-keyed Hartley oscillators associated with conventional organ controls. Each oscillator provides a sinusoidal fundamental and a pulse signal having many harmonics. Mixer circuits combine the fundamentals and pulse signals in the required proportions, the output being fed to frequency-discriminating circuits to produce the required note. Doppler effect is minimized by using separate loudspeaker channels for manuals and pedals. The power amplifiers have low intermodulation distortion.

621.384.6 **2584**

A Linear Electron Accelerator.—E. L. Ginzton, W. W. Hansen & W. R. Kennedy. (*Rev. sci. Instrum.*, Feb. 1948, Vol. 19, No. 2, pp. 89–108.) Theory, design and experimental results are discussed. Orbital instability can be neglected provided that the electrons are injected at relativistic velocities ; space-charge spreading may then also be neglected. The optimum loading design is found for various types of power feeds, and curves to assist calculation are given. Illustrative cases are discussed, and the operation of a low-power 38-section accelerator is described. A footnote (pp. 89 and 90) lists organizations and key personnel working on linear accelerators, and gives a few references.

621.384.6 **2585**

Design Calculations for a Spiral Accelerator for Heavy Particles.—W. Dällenbach. (*Helv. phys. Acta*, 25th Feb. 1948, Vol. 21, No. 1, pp. 21–48. In German.)

621.384.6 **2586**

Measurement of the Electron Current in a 22-MeV Betatron.—L. Bess & A. O. Hanson. (*Rev. sci. Instrum.*, Feb. 1948, Vol. 19, No. 2, pp. 108–110.) The charge accelerated to high energy in a 22-MeV betatron operating at 180 c/s is determined from its magnetic effect, and corresponds to an average current of about $0.15\ \mu$A.

534.321.9.001.8 **2587**

Industrial Applications of Ultrasonics. [Book Notice]—P. Alexander. B.I.O.S. Final Report No. 1504. H.M. Stationery Office, London, 11 pp., 3s. 6d. Some experimental applications are described, including a method of soldering Al without flux.

551.508.1 **2588**

A New Frequency Modulated Radiosonde. [Book Notice]—E. Menzer & K. Sittel. F.I.A.T. Final Report No. 1175. H.M. Stationery Office, London, 21st July 1947, 7 pp., 1s. 6d. In German with English summary.

Apparatus designed for mass production. For temperature measurements a capacitor with a high temperature coefficient and another with a very low temperature coefficient are switched alternately into the anode circuit of the transmitter, temperatures being determined from the resulting frequency difference. Relative humidity and pressure are determined also by frequency changes resulting from capacitance changes. The construction of the apparatus and its calibration and testing are described, but no circuit details are given.

PROPAGATION OF WAVES

538.566 **2589**

Surface Impedance of an Infinite Parallel-Wire Grid at Oblique Angles of Incidence.—G. G. Macfarlane. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 10, pp. 1523–1527.) The shunt reactance (X) of the grid, in terms of the component of the wave impedance (Z) of the incident plane wave which is normal to the grid, is found to be

$$X = [\log (d/2\pi a) + F\ (d/\lambda,\ \theta)]\ Zd/\lambda$$

where d = spacing of wires, a = radius of each wire, θ = angle of incidence, and F is shown graphically. An expression for the reflection coefficient is given. The shunt reactance is substantially independent of the angle of incidence when $a \ll d \ll \lambda$.

621.396.11 **2590**

1948 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs, W. & E.*, March 1948, Vol. 36, No. 3, pp. 365–380.) Abstracts are given of the following papers read at the Convention :—Continuous Tropospheric Sounding by Radar, by A. W. Friend. A Theory on Radar Reflections from the Lower Atmosphere, by W. E. Gordon. The Propagation of Radio Waves through the Ground, by K. McIlwain & H. A. Wheeler. Design and Application of a Multipath Transmission Simulator, by H. F. Meyer & A. H. Ross. Titles of other papers are given in other sections.

621.396.11 : 530.12 : 531.18 **2591**

The Formulae for the Doppler Effect in the Ellipsoidal Theory of Special Relativity (Error of Einstein's Formulae).—J. Dreyfus-Graf. (*Helv. phys. Acta*, 25th Feb. 1948, Vol. 21, No. 1, pp. 87–92. In French.) A discussion of the case where the distance between a transmitter and a receiver changes at a constant rate. The formulae derived for the Doppler effect are compared with those of Einstein, which appear to contain an error, since they show that the phase velocity is not the same in all directions and is different from the stationary velocity. This is contradicted by the results of the Michelson-Morley experiment. The ellipsoidal formulae give the same phase velocity in all directions. See also 2058 of 1947.

621.396.11 : 535.3 **2592**

Intensity-Distance Law of Radiation.—D. A. Bell. (*Wireless Engr*, June 1948, Vol. 25, No. 297, p. 199.) For a conical radio beam issuing from a point source, the energy intensity varies as r^{-2} at distance r. For a parallel-beam optical searchlight the energy intensity falls off less rapidly. The dividing line between the optical case and the radio case occurs at a distance $r_0 = d^2/0.52\lambda$ from the source where d is the diameter of the actual source.

621.396.11 : 551.510.52 **2593**

Continuous Tropospheric Soundings by Radar.—A. W. Friend. (*Proc. Inst. Radio Engrs, W. & E.*, April 1948, Vol. 36, No. 4, pp. 501–503.) Describes in some detail experiments carried out on 2.398 and 2 800 Mc/s. On many occasions boundaries between air masses of different dielectric constant and scattering due to precipitation were observed continuously. The results are compared with theory indicating orders of magnitudes of reflection coefficients to be expected. With a perfectly clear sky numerous momentary 'dot' echoes were observed, apparently corresponding to the top of a moist stratum of air. The results are compared with those of other observers. See also 2062 of July (Ryde).

621.396.11 : 551.510.535 **2594**

Magnetoionic Multiple Refraction at High Latitudes.—S. L. Seaton. (*Proc. Inst. Radio Engrs, W. & E.*, April 1948, Vol. 36, No. 4, pp. 450–454.) Experimental ionospheric soundings examined by Scott & Davies (URSI–IRE Joint Meeting, 6th May 1947, Paper No. 25) are cited, and these authors' interpretation of multiple refraction is compared with the theory of Appleton & Builder (1933 Abstracts, p. 262), with special reference to effects to be expected in high latitudes. Experimental evidence is offered to show that the '*Z*' component of Scott & Davies is probably the longitudinal ordinary ray predicted by Appleton & Builder, and by Taylor (1933 Abstracts, p. 263 and 1934 Abstracts, p. 373), when collision frequency is appreciable. Using stated assumptions the collision frequency near Fairbanks, Alaska, is calculated to be about 4×10^4 at a height of 300 km.

621.396.11 : 551.510.535 **2595**

Triple Magneto-Ionic Splitting of Rays reflected from the F_2 Region.—G. Newstead. (*Nature, Lond.*, 28th Feb. 1948, Vol. 161, No. 4087, p. 312.) A good example from the Hobart $P'f$ recorder operating in the frequency range 1.5–13 Mc/s is reproduced. A systematic discrepancy between the expected and observed critical frequency for the third ray is possibly accounted for by collision. Triple splits seem more likely to occur under disturbed conditions and are generally accompanied by sporadic-E ionization. They have been observed at all hours of the day, but are most frequent between 1700 and 2000 G.M.T.

RECEPTION

621.396.62 **2596**

1948 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs, W. & E.*, March 1948, Vol. 36, No. 3, pp. 365–380.) Abstracts are given of the following papers read at the Convention :—I.F. Design for F.M. Receivers, by K. E. Farr. Static-Free Systems of Detection, by D. L. Hings. Superregeneration as it emerges from World War II, by H. A. Wheeler. Theory of the Superregenerative Receiver, by W. E. Bradley. Superregeneration—An Analysis of the Linear Mode, by H. A. Glucksman. External and Internal Characteristics of a Separately Quenched Superregenerative Circuit, by Sze-Hou Chang. The Hazeltine FreModyne Circuit, by B. D. Loughlin. The Application of Noise Theory to the Design of Receivers, by W. A. Harris. The Design of [receiver] Input Circuits for Low Noise Figure, by M. T. Lebenbaum. Frequency Converters, by W. H. Lewis. Titles of other papers are given in other sections.

621.396.621 **2597**

Simplified Single-Sideband Reception.—O. G. Villard, Jr. (*Electronics*, May 1948, Vol. 21, No. 5, pp. 82–85.) The given circuit can be used with a conventional communications receiver for the reception of code signals as well as single-sideband transmissions. The effective i.f. bandwidth of a receiver can be made exactly that of the passband of a low-pass audio filter, instead of approximately twice this passband as in a.m. The circuit includes a demodulating oscillator, balanced detector, two 90° audio phase-shift networks and a low-pass filter. See also 4027 of 1947 (Lenehan).

621.396.621 **2598**

A Double-Diversity Two-Channel Single-Sideband Receiver.—L. K. Curran. (*A.W.A. tech. Rev.*, Oct. 1947, Vol. 7, No. 4, pp. 337–354.) Discussion of the advantages and requirements of such a system, and of the receiving equipment at the Australian terminal of the London and San Francisco circuits. The double-superheterodyne receiver converts signals to an i.f. of 1 666 kc/s and subsequently to 100 kc/s, at which frequency channel selection is performed by lattice-type crystal filters. The partially suppressed carrier is selected by narrow-band T-section crystal filters and compared with the locally-generated carrier to provide a.f.c. Graphs illustrate filter and channel characteristics ; typical data of sensitivity, selectivity, etc., are included.

621.396.621 **2599**

Radio Set and Service Review. The Collins Model 75A-1.—R. F. Scott. (*Radio Craft*, Feb. 1948, Vol. 19, No. 5, pp. 32–33 . . 75.) A 14-valve receiver with 6 tuning ranges, one for each amateur band. Other features are permeability tuning, double conversion, a well-calibrated mechanical bandspread system and stable crystal-controlled oscillators.

621.396.621 **2600**

A Panoramic Receiver (3.5-20 Mc/s).—E. C. H. Seaman. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 13, pp. 459–460 ; summary, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 82.) The receiver is designed to indicate simultaneously on a c.r. tube the presence, frequency and relative magnitude of strong signals. A superheterodyne arrangement is used in which the input tuning is unchanged and the local oscillator frequency is varied cyclically. The output from the set controls the Y-deflection of the tube, while the X-deflection is synchronized with the local oscillator frequency sweep.

621.396.621.59 **2601**

Squelch Circuits for F.M. Receivers.—C. W. Carnahan. (*Electronics*, April 1948, Vol. 21, No. 4, pp. 98–99.) Simple circuits for rendering the audio amplifier of a f.m. broadcast receiver inoperative when tuning between stations. In several arrangements described, the second limiter supplies squelch voltage without additional valves.

621.396.82 **2602**

Radio Interference from Aircraft Electrical Equipment.—L. Rowley. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 13, pp. 484–492 ; summary, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 82.) The causes and means of propagation of interference, and various methods of interference suppression, are summarized. The main remedy is the screening of possible sources of interference and the installation at these sources of suppressors whose behaviour should be predictable over a wide frequency range. Different types of suppressors and their components are described, with performance details and values and characteristics of low-inductance through-conductor capacitors and light dust-core inductors. Methods of testing suppression apparatus are briefly discussed.

621.396.822 **2603**

On the Number of Signals Discernible in the Presence of Random Noise in a Transmission System with a Limited Passband.—J. Laplume. (*C. R. Acad. Sci., Paris,* 26th April 1948, Vol. 226, No. 17, pp. 1348–1349.)

621.396.822 : 523.746 **2604**

Sunspots and Radio.—H. T. Stetson. (*Radio Craft,* Feb. 1948, Vol. 19, No. 5, pp. 24–25, 72.) Discussion of the bearing of solar activity on radio communication.

621.396.822 : 621.396.619 **2605**

Noise Problems in Pulse Communication.—Z. Jelonek. (*J. Instn elect. Engrs,* Part IIIA, 1947, Vol. 94, No. 13, pp. 533–545 ; summary, *ibid.,* Part IIIA, 1947, Vol. 94, No. 11, p. 105.) Formulae for random noise in the a.f. output in pulse-communication receivers are given for various p.m. systems, particularly those in which the received pulses are sliced. Noise resulting from random distribution of the i.f. phase at the onset of pulses is also considered. The slicing level for minimum output noise is evaluated.

Signal/noise ratio and threshold formulae thus obtained are compared with those for a.m. and f.m. systems. The relative merits of modulation systems are discussed in terms of graphs of output signal/noise ratio. Performance below threshold is taken into account.

621.396.822 : 621.396.619.16 **2606**

Random Noise Characteristics of a Pulse-Length-Modulated System of Communication.—G. G. Gouriet. (*J. Instn elect. Engrs,* Part IIIA, 1947, Vol. 94, No. 11, pp. 551–555.) A theoretical analysis for a system in which the detected pulses are limited in amplitude and applied to a low-pass filter. For r.f. bandwidths as great as 300 kc/s there will be no substantial improvement over a.m. ; for greater bandwidths the improvement will be approximately proportional to the square root of the bandwidth. See also 2620 below.

621.396.822 : 621.396.619.16 **2607**

Noise-Suppression Characteristics of Pulse-Time Modulation.—S. Moskowitz & D. D. Grieg. (*Proc. Inst. Radio Engrs, W. & E.,* April 1948, Vol. 36, No. 4, pp. 446–450.) An experimental investigation. Impulse noise and thermal-agitation or fluctuation noise are considered. Their effects, and improvements obtained by using limiters, differentiators and multivibrators, are shown graphically.

621.396.828 : 621.319.4 **2608**

The Duct Capacitor.—Watton. (*See* 2474.)

621.396.621.53 **2609**

Microwave Mixers. [Book Review]—R. V. Pound & E. Durand. McGraw-Hill, London, 381 pp., 33s. (*Wireless Engr,* June 1948, Vol. 25, No. 297, p. 197.) Volume 16 of the M.I.T. Radiation Laboratory series on radar and related techniques, covering most of the developments during and since the war, chiefly for λ 10 cm and λ 3 cm. Principles of mixer design, the r.f. head for radar, waveguide and coaxial-line circuits, a.f.c., and mixer measurements, are among the subjects discussed.

STATIONS AND COMMUNICATION SYSTEMS

621.395.44 **2610**

SOJ-12 Open-Wire Carrier Telephone Systems in South Africa.—D. P. J. Retief & H. J. Barker. (*Elect. Commun.,* Sept. 1947, Vol. 24, No. 3, pp. 310–323.) General description of a system providing 12 additional two-way speech channels over an open-wire pair on which a 3-channel carrier telephone system and voice facilities may already be operating.

621.395.44 : 621.315.052.63 **2611**

M1 Carrier : The Common Terminal.—R. C. Edson. (*Bell Lab. Rec.,* Feb. 1948, Vol. 26, No. 2, pp. 77–81.) Details of the equipment used at the junction of power and telephone lines in the M1 carrier system. See also 1490 of May (Hochgraf) and 2612 below.

621.395.44 : 621.315.052.63 **2612**

Carrier Telephones for Farms.—J. M. Barstow. (*Bell Lab. Rec.,* Oct. 1947, Vol. 25, No. 10, pp. 363–366.) Description of the M1 system. See also 1490 of May (Hochgraf), 2355 of August (Dunham), 2611 above and 2629 below.

621.395.97 : 621.315.052.63 **2613**

Tele-Broadcasting on Low-Voltage Distribution Networks.—E. Metzler & W. Rüegg. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.,* 1st Feb. 1948, Vol. 26, No. 1, pp. 30–35. In French.) In many parts of Switzerland the field strength is too low for satisfactory reception from the national transmitters. In some places this difficulty has been overcome by means of a h.f. system applied on the telephone lines. Tests are here reported of such a system applied on the l.v. distribution network. At three places long waves (150–300 kc/s) were used, the maximum power of the transmitter being about 5 W. At a fourth place a quartz-controlled transmitter was used, giving a maximum output of 4.5 W at 175 kc/s. The results obtained were quite satisfactory and show that such low-power transmitters can provide good service for a locality where the number of subscribers does not exceed 2 000.

621.396 **2614**

1948 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs, W. & E.,* March 1948, Vol. 36, No. 3, pp. 365–380.) Abstracts are given of the following papers read at the Convention :—A Proposed Combined F.M. and A.M. Communication System, by J. C. O'Brien. Ratio of Frequency Swing to Phase Shift in Phase- and Frequency-Modulation Systems Transmitting Speech, by D. K. Gannett & W. R. Young. A New Magnetron Frequency Modulation Method, by P.H. Peters. Technical Aspects of Experimental Public Telephone Service on Railroad Trains, by N. Monk & S. B. Wright. Reflected-Power Communication, by H. Stockman. Selective-Sideband Transmission and Reception, by D. E. Norgaard. Theoretical Study of Pulse-Position Modulation without Fixed Reference, by A. E. Ross. High-Quality Radio Program Links, by M. Silver & H. A. French. Signal-to-Noise Ratio Improvement in a P.C.M. [pulse-count modulation] System, by A. G. Clavier, P. F. Panter & W. Dite. Radio-Wire Links for Multichannel Transmission, by E. M. Ostlund & H. R. Hunkins. Bandwidth Reduction in Communication Systems, by W. G. Tuller. Titles of other papers are given in other sections.

621.396.41.015.33 : 621.396.82 **2615**

Pulse Communication on Lines.—S. H. Moss & G. H. Parks. (*J. Instn elect. Engrs,* Part IIIA, 1947, Vol. 94, No. 13, pp. 503–510 ; summary, *ibid.,* Part IIIA, 1947, Vol. 94, No. 11, p. 106.) Discussion of communication over a 50-mile open-wire line of standard British Army type. The problem of adjacent-channel interference, caused by progressive deterioration of the individual pulse waveforms to a point where overlapping occurs, is solved by transmitting a controllable curbed pulse instead of a simple rectangular pulse. This reduces the interfering effect of each trailing pulse response. Crosstalk results are satisfactory for one-way communication. For two-way operation, unless the line is sufficiently smooth, near-end interference due to reflections from irregularities in the line may make crosstalk intolerable.

621.396.41.029.62 : 621.396.611.21 **2616**

Reference - Crystal - Controlled V.H.F. Equipment.—D. M. Heller & L. C. Stenning. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 13, pp. 461–474.) Discussion of methods of obtaining automatic selection of any channel (' asac ') and controlling a large number of channels with a small number of crystals. The frequency of one crystal is used to define the channel separation ; methods of channel selection are discussed. Detailed circuit diagrams of an ' asac ' transmitter-receiver Type TR1407 are given. See also 2342 of August (Hedeman).

621.396.619.13 **2617**

Frequency Modulation.—E. Schwartz. (*Arch. elekt. Übertragung*, Nov./Dec. 1947, Vol. 1, Nos. 5/6, pp. 220–236.) General review, with a bibliography of 122 references.

621.396.619.16 **2618**

Pulse Communication.—D. Cooke ; Z. Jelonek & E. Fitch ; A. J. Oxford. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 13, pp. 583–588.) Discussion on 2079 of July.

621.396.619.16 **2619**

The Spectrum of Modulated Pulses.—E. Fitch. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 13, pp. 556–564.) The basic p.m. systems are defined and the spectrum of a train of rectangular pulses sinusoidally modulated in any one of these systems is derived. Modulation by more than one tone is considered. No harmonic distortion or audio crosstalk occurs. The anharmonic distortion due to sidebands of harmonics of the pulse repetition frequency is shown graphically. The distortions to be expected for non-rectangular pulses are practically the same as for rectangular pulses. Transients apparently suffer little distortion in form, but their timing is shifted by the p.m., the maximum shift being half the pulse repetition period.

621.396.619.16 **2620**

Some Theoretical and Practical Considerations of Pulse Modulation.—M. M. Levy. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 13, pp. 565–572 ; summary, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 105.) The main conclusions are :— (*a*) Pulse-phase modulation introduces no amplitude distortion except at submultiples of the pulse recurrence frequency. (*b*) Harmonic distortion is negligible, and this method of modulation can be used for high-quality broadcasting. (*c*) Pulse-phase modulation is subject to cross-distortion produced by sidebands of the pulse recurrence frequency which are within the signal bandwidth. This distortion is negligible provided that the pulse recurrence frequency is at least double the highest signal frequency to be transmitted.

The signal/noise ratio for pulse-phase modulation is higher than for a.m. and increases with the bandwidth used ; a formula for the improvement is given. A practical circuit for suppressing the noise on the synchronizing pulse is described, and the elimination of harmonic distortion, due to imperfections in the shape of the modulator and demodulator pulses, is considered.

621.396.619.16 **2621**

A New Method of Wide-Band Modulation of Pulses.—G. H. Parks & S. H. Moss. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 13, pp. 511–516 ; summary, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 106.) A theoretical and experimental investigation into the design of a modulator and demodulator for a single-channel pulse system to operate as a link in a multi-channel carrier-telephony system (0.3–32 kc/s) requiring low overall noise and low crosstalk. The modulating signal is scanned periodically instead of synchronously. This permits the use of a low recurrence frequency (actually 80 kc/s for ease of filtering). There is a consequent improvement in the signal/noise ratio.

621.396.619.16 **2622**

Pulse-Count Modulation.—D. D. Grieg. (*Elect. Commun.*, Sept. 1947, Vol. 24, No. 3, pp. 287–296.) For another account see 544 of February.

621.396.619.16 **2623**

Pulse-Time-Modulation Link for Army Field Telephone System.—N. H. Young. (*Elect. Commun.*, Sept. 1947, Vol. 24, No. 3, pp. 297–299.) A method of obtaining duplex transmission over a radio link, using a single channel and common-aerial working. Pulse repetition is controlled at both stations from a single stable oscillator. By suitable timing, pulse reception at either station occurs in the intervals between pulse transmission. A brief description is given of practical equipment, the performance of which compared favourably with standard telephone circuits.

621.396.619.16 : 621.395.43 **2624**

The Development of the Wireless Set No. 10 : An Early Application of Pulse-Length Modulation.—E. G. James, J. C. Dix, J. E. Cope, C. F. Ellis & E. W. Anderson. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 13, pp. 517–527 ; summary, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 105.) An interlaced multichannel telephone circuit using pulse-length modulation, applied to a cm-λ radio link. The transmitter uses magnetrons of the resonant-segment glass-envelope type, the wavelengths being 6.6 and 6.3 cm for duplex operation. The receiver has a tuning range of 6.1–6.8 cm, and a straight 45-Mc/s i.f. amplifier of bandwidth 4 Mc/s. The aerial system consists of two parabolic reflectors, and uses vertical polarization. See also 470 and 2706 of 1946, and 236 of 1947.

621.396.619.16 : 621.396.41 **2625**

A 60-cm Multi-Channel System employing Pulse-Phase Modulation.—D. G. Reid. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 13, pp. 573–583 ; summary, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 106.) A system intended for ground point-to-point use, which provides up to 12 simultaneous channels of two-way telephone communication. The operating frequency band is 450–500 Mc/s, and directional aerials having a beam-width of approximately ±15° are used. The transmitter has a peak power of about 200 W, which is sufficient for line-of-sight paths up to 100 miles long.

621.396.619.16 : 621.396.5 **2626**

Pulse Code Modulation.—F. Shunaman. (*Radio Craft*, Feb. 1948, Vol. 19, No. 5, pp. 28–30, 47.) Description of the Bell experimental system. See also 1499 of May and back references.

621.396.619.16 : 621.396.5 **2627**

High-Power Pulse Communication at Centimetre Wavelengths.—A. T. Starr. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 13, pp. 546–550 ; summary, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 106.) Discussion of the application of microwave radar technique to single-channel pulse telephony. One of the two methods of modulation uses a gating system with automatic synchronization to reduce interference. Pulsed magnetrons and klystrons give an output peak power of $\frac{1}{2}$ kW or more. Reasonable agreement is obtained between theoretical and experimental values of the signal/noise ratio. Suggestions are made for improved discrimination between channels.

621.396.65 + 621.396.93 + 621.396.75 **2628**

Angola Radio Network.—C. Pelaez. (*Elect. Commun.*, Sept. 1947, Vol. 24, No. 3, pp. 283–286.) Brief illustrated description of (*a*) overland links within the colony, (*b*) stations for communication with ships at sea and with aircraft, and (*c*) Adcock-type direction finders.

621.396.65 **2629**

Rural Radiotelephone Experiment at Cheyenne Wells, Colo.—J. H. Moore, P. K. Seyler & S. B. Wright. (*Bell Syst. tech. Publ. Monogr.*, B-1476, 4 pp.; *Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 525–528.) A party-line system using a f.m. radio link on 40–50 Mc/s between subscribers and a local exchange. See also 1490 of May (Hochgraf) and 2612 above.

621.396.65 **2630**

Rural Party-Line Service by Radio.—H. W. Nylund. (*Bell Lab. Rec.*, Feb. 1948, Vol. 26, No. 2, pp. 49–54.) An experimental R/T system operating in the 44–50-Mc/s band. Existing mobile equipment is used, with modified power supplies. F.m. is used for speech and a.m. for the ringing current. The aerials are $\lambda/2$ vertical dipoles.

621.396.65 **2631**

Radio Communication on Middle East Oil Pipeline.—(*Engineering, Lond.*, 13th Feb. 1948, Vol. 165, No. 4281, p. 163.) For another account see 2368 of August.

621.396.65 + 621.396.7] (494) **2632**

High-Altitude Stations and Radio Links.—W. Gerber & F. Tank. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st Feb. 1948, Vol. 26, No. 1, pp. 21–30. In French.) See 546 of February.

621.396.93 **2633**

Military and Aeronautical Communication.—(*J. Inst. elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 13, pp. 492–496.) Discussion on 2083 of July (Hickman) and 2085 of July (Gates).

621.396.933 **2634**

Simultaneous Radio Range and Radiotelephone Equipment.—G. T. Royden. (*Elect. Commun.*, Sept. 1947, Vol. 24, No. 3, pp. 374–381.) A brief survey of the development and principles of operation, followed by a detailed description of the equipment installed in the principal U.S. airports. A and N morse signals are transmitted on two pairs of vertical aerials, giving equisignal courses, which may be rotated or 'squeezed' to any desired directions. A central aerial transmits speech-modulated signals, which are received simultaneously with the range signals.

621.396.933 : 621.396.619.16 **2635**

A Common-Wave Duplex Pulse-Communication System.—J. H. McGuire & P. J. Nowacki. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 13, pp. 528–532; summary, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 106.) Discussion of a system using only one carrier frequency and suitable for air-to-air and air-to-ground R/T. Duplex operation is achieved by momentary suppression of the receivers at each end of a communication link for the duration of each transmitter pulse. Pulse-phase modulation is used; the pulse recurrence frequencies of the transmissions in the two directions are not synchronized. A memory type of pulse-phase discriminator introduces little noise.

621.396.933 : 621.398 **2636**

Telecontrol of Aeradio Ground-Station Receivers.—J. E. Benson & W. A. Colebrook. (*A.W.A. tech. Rev.*, Oct. 1947, Vol. 7, No. 4, pp. 407–419.) Reprint of 275 of January.

621.396.97 **2637**

On the Provision of Broadcasting Services.—F. Eppen. (*Frequenz*, Feb. 1948, Vol. 2, No. 2, pp. 31–41.) Discussion of such factors as the number of possible subscribers to a new broadcasting service, technical and organization problems, choice of wavelength, topography of the terrain near the proposed station, power requirements, fading and methods for minimizing it, and common-frequency operation. Developments in Germany up to the end of the war are reviewed.

621.396.619.13 **2638**

FM Simplified. [Book Review]—M. S. Kiver. D. Van Nostrand, New York, 1947, 342 pp., $6.00. (*Proc. Inst. Radio Engrs, W. & E.*, April 1948, Vol. 36, No. 4, p. 512.) "The treatment is 'complete' in the sense that all phases of the subject are treated, and is 'not exhaustive' in the sense that merely a qualitative description of the various phases is given without detailed mathematical proofs."

SUBSIDIARY APPARATUS

621-526 + 621.396.68 **2639**

1948 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs, W. & E.*, March 1948, Vol. 36, No. 3, pp. 365–380.) Abstracts are given of the following papers read at the Convention:—Servo-System Performance Measurement, by C. F. White. Stable Regulated Power Supplies, by R. R. Buss. Titles of other papers are given in other sections.

621.314.67 : 621.385.38 : 621.316.722.1 **2640**

The Shunt Tube Control of Thyratron Rectifiers.—J. A. Potter. (*Bell Syst. tech. Publ. Monogr.*, B-1464, 4 pp.; *Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 421–425.) A description of simple and relatively inexpensive control circuits designed to provide close stabilization of the d.c. output.

621.316.729 : 621.313.323 **2641**

A Phase-Sensitive Synchronous Motor.—J. F. Allen. (*A.W.A. tech. Rev.*, Oct. 1947, Vol. 7, No. 4, pp. 355–359.) The two input frequencies are fed through a RC phase-shifting network to two amplifying stages. The output of each stage is fed to one of the crossed field coils of a phonic motor.

The armature pulls into and rotates in synchronism with the rotating oscillating field for suddenly-produced differences of up to 10 c/s, for a power of 6 W supplied to the field coils.

621.316.97 **2642**

Construction of Shielded Room in V.H.F. Field.—C. C. Pine. (*Electronics*, April 1948, Vol. 21, No. 4, pp. 150..158.) Construction details for a room screened over the whole r.f. spectrum. The outermost shield consists of $\frac{1}{4}$-inch galvanized-wire mesh; the second shield, for u.h.f. screening, consists of graphite-impregnated cloth, and the inside of the room is lined with copper foil. The filtering of the power supply and the bonding of the door require special care. See also 2279 of August (Norton).

621.318.572 : 621.396.67 **2643**

Electronic Switches for Single-Aerial Working.—A. H. Cooke, G. Fertel & N. L. Harris. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 10, pp. 1575–1584.)

Discussion of: (*a*) the purpose of these switches in radar equipments, (*b*) the development of the spark-gap type as used in cm-λ sets, (*c*) the development of the gas-filled resonator type of cell for use at cm λ, (*d*) methods of performance measurement.

621.319.33 **2644**

The Electric Fields in Electrostatic Generators with Inductors charged by Ionization.—P. Jolivet. (*C. R. Acad. Sci., Paris*, 19th Nov. 1945, Vol. 221, No. 21, pp. 613–614.) The results of tests with propane (C_2H_8), N and CO_2 as gas filling for such generators, at pressures from atmospheric to several kg/cm^2, show that the best results were obtained with CO_2 at a pressure 3 kg/cm^2 above atmospheric.

621.352.7 **2645**

Dry Battery Developments. The R.M. [Ruben-Mallory] **Mercury Cell.**—R. W. Hallows; D. W. Thomasson. (*Wireless World*, May 1948, Vol. 54, No. 5, pp. 166–168.) Recent developments in cell design permit a reduction in dimensions for a given capacity. The Hg cell has an anode of Zn foil or powdered Zn, the electrolyte is a solution of KOH and the steel container forms the cathode. A pellet of HgO acts as a depolarizing anode.

621.396.681 **2646**

Power Supplies for Aircraft Communication Equipment.—W. J. Scott. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 13, pp. 475–483; summary, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 82.) Discussion of the effect of the aircraft's general electrical system on radio power supplies and the different types of voltage conversion and regulation equipment used for these supplies. Characteristics of a typical rotary transformer and performance details for typical vibrator converters and voltage regulators are also given.

TELEVISION AND PHOTOTELEGRAPHY

621.397 **2647**

1948 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs, W. & E.*, March 1948, Vol. 36, No. 3, pp. 365–380.) Abstracts are given of the following papers read at the Convention:—A Unitary Tuner-Amplifier for Television Receivers, by E. L. Crosby, Jr, G. W. Clevenger & H. Goldberg. A Picture-Modulated R.F. Generator for Television Receiver Measurement, by A. Easton. The Application of Projective Geometry to the Theory of Color Mixture, by F. J. Bingley. Reflection of Television Signals from Tall Buildings, by A. Alford & G. J. Adams. Field Coverage Considerations of New York Television Stations, by T. T. Goldsmith, Jr, & R. P. Wakeman. Titles of other papers are given in other sections.

621.397.2 **2648**

Facsimile Transmitter at the Miami Herald, Florida.—R. G. Peters. (*Communications*, Feb. 1948, Vol. 28, No. 2, pp. 12–15, 33.) Details of scanner and limiting amplifiers, pulse generator, recorder amplifier and modulator, and of method of phase adjustment for synchronization.

621.397.335 : 621.318.572 **2649**

Counter Circuits for Television.—Easton & Odessey. (*See* 2472.)

621.397.5 **2650**

Considerations on the Selection of Television Standards.—J. L. Delvaux. (*Rev. tech. Comp. franç. Thomson-Houston*, Jan. 1948, No. 9, pp. 5–38. In French, with English summary.) The choice depends on the kind of service required. For a limited number of large-screen receivers a 700-line standard appears desirable, with a transmission frequency not exceeding 200 Mc/s. For normal broadcasting, medium definition standards (400–455 lines) are favoured, with transmission on long metre waves or in some exceptional cases on short metre waves. For increasing the number of available channels quasi-single-sideband transmission of the video signals is suggested.

621.397.5 : 535.88 **2651**

Compact Projection Television System.—H. G. Boyle & E. B. Doll. (*Electronics*, April 1948, Vol. 21, No. 4, pp. 72–77.) A triangular arrangement of the Schmidt optical system. The projection box uses a 2.5-inch c.r. tube and gives a 12-inch by 16-inch picture.

621.397.5 : 535.88 **2652**

Method of Computing Correction Plate for Schmidt System for Near Projection, with Special Reference to System for Television Projection.—H. S. Friedman. (*J. opt. Soc. Amer.*, June 1947, Vol. 37, No. 6, pp. 480–484.) A plano-aspherical lens, shaped so as to free the centre of the field from spherical aberration for a particular wavelength, is computed. A method of determining the chromatic aberration due to the plate is described and means of minimizing chromatic error are indicated. The system is examined for freedom from coma. The curvature of the tube face required to produce a flat image on the screen is deduced.

621.397.743 **2653**

A New Microwave Television System.—J. F. Wentz & K. D. Smith. (*Bell Syst. tech. Publ. Monogr.*, B-1461, 6 pp.; *Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 465–470.) An illustrated outline of a f.m. system for the relaying of television programmes, using frequencies from 3 900 to 4 400 Mc/s. The transmitting and receiving aerials are separate, and may be of the shielded lens or parabolic type according to local conditions. Pairs of filters are provided for 2-channel operation. The transmitter consists of a video amplifier feeding a 0.4-W r.f. oscillator. The modulation voltage normally used gives a total frequency swing of about 5 Mc/s. The receiver consists of a hybrid converter and preamplifier feeding the main i.f. and video amplifiers. It has a maximum peak-to-peak output of about 2 V into a balanced 75-Ω load. Various refinements are described and brief performance details are given.

TRANSMISSION

621.396.61 : 621.396.828 **2654**

Eliminating Spurious Radiations from BC Transmitters.—V. J. Andrew. (*Tele-Tech*, Feb. 1948, Vol. 7, No. 2, pp. 22–26..59.) The causes of such unwanted radiations are discussed, methods of locating their source are described and design data for harmonic suppression filters are tabulated.

621.396.61.029.62 **2655**

50 kW Output on 88 to 108 Mc/s.—A. Arigoni. (*FM & Televis.*, Feb. 1948, Vol. 8, No. 2, pp. 37–39.) A description of the prototype of a transmitter designed for f.m. broadcasting. Two intermediate power-amplifier stages deliver 13 kW to the final stage, which uses two push-pull grounded-grid triodes, Type 3X12500A3. These valves consist of 4 units of the 3X2500A3 type, assembled on a common mounting; individual units can be replaced by the makers. The total weight of the 4-unit valve is 32 lb.

621.396.619.13 **2656**

A Method of Obtaining Linear Frequency Deviation in a Wide-Band Frequency-Modulation System.—Z. K. Hass. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 13, pp. 497–502 ; summary, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 105.) The primary cause of harmonic distortion in a f.m. system is the nonlinearity of the slope of the reactance valve. A method of improving the linearity of this slope is described ; harmonic distortion is thus reduced to about 60 db below the fundamental. A method of checking high-fidelity f.m. is also discussed.

621.396.619.23 **2657**

Extending Linear Range of Reactance Modulators.—F. Brunner. (*Electronics*, May 1948, Vol. 21, No. 5, pp. 134, 168.) Frequency deviations of 10% of the mean frequency can be obtained by incorporating a stage of amplification in the basic reactance-valve f.m. oscillator circuit. Refinements are discussed.

VALVES AND THERMIONICS

621.314.632 : 546.28 **2658**

A Silicon-Metal Contact Resistance.—Putley. (*See* 2537.)

621.314.67 **2659**

High Altitude Tube.—N. Anton & M. Youdin. (*Electronics*, April 1948, Vol. 21, No. 4, pp. 95–97.) A rectifier valve with a special anti-corona base fitting into a moulded socket, which can be operated at full rating in guided missiles at great heights, or in industrial equipment subject to dust, moisture and fumes.

621.383 **2660**

Lead Telluride Cells for Infra-Red Spectroscopy.—O. Simpson, G. B. B. M. Sutherland & D. E. Blackwell. (*Nature, Lond.*, 21st Feb. 1948, Vol. 161, No. 4086, p. 281.) Preliminary results for cells prepared by the evaporation method. Sensitivity is nil at ordinary temperatures, but at the temperature of liquid air the sensitivity has a maximum between 2 μ and 3 μ which is about the same as that of the best PbS cells. Some sensitivity is found as far as 5.5 μ. See also 1815 of June.

621.383 **2661**

High-Frequency Characteristics of Lead Sulphide and Lead Selenide Layers.—R. P. Chasmar. (*Nature, Lond.*, 21st Feb. 1948, Vol. 161, No. 4086, pp. 281–282.) Discussion of the results of impedance measurements on PbS and PbSe photoconductive cells, at frequencies high enough to ensure the short-circuiting of the intercrystal barrier layers.

621.383 **2662**

Spectral Response of Lead Selenide.—T. S. Moss & R. P. Chasmar. (*Nature, Lond.*, 14th Feb. 1948, Vol. 161, No. 4085, p. 244.) Photocells constructed with a window of KRS5 material (a mixture of TlBr and TlI) show a response which at 90°K is practically flat from about 2 μ to 4.2 μ and about 50% lower at 5 μ. At 195°K the flat portion of the response curve extends to about 3.5 μ, falling about 50% towards 4 μ. Both curves show a peak at about 1.2 μ which is thought to be due to impurities.

621.385 + 621.396.615 **2663**

1948 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs, W. & E.*, March 1948, Vol. 36, No. 3, pp. 365–380.) Abstracts are given of the following papers read at the Convention :—Thermionic Emission from Grids in Vacuum Tubes, by M. Arditi & V. J. DeSantis. The Negative-Ion Blemish in a Cathode-Ray Tube and Its Elimination, by R. M. Bowie. Wide-Tuning-Range Continuous-Wave High-Power Magnetrons, by P. W. Crapuchettes. Wide-Range Tuning Systems for Magnetrons, by E. N. Kather. Design Characteristics of Hearing-Aid Tubes, by G. W. Baker. Experimental Study of the Effects of Transit Time in Class-C Power Amplifiers, by O. Whitby. New Receiving Tubes for Industrial Use, by C. M. Morris & H. J. Prager. A Standard Diode for Radio-Tube-Cathode Core-Material Approval Tests, by R. L. McCormack. European Practices in the Manufacture of Cathodes, by T. H. Briggs. Processing Vacuum-Tube Components, by P. D. Williams. Continuous Exhaust Machine for Electron-Tube Manufacture, by L. G. Hector. New Design for a Secondary-Emission Trigger Tube—NU TR-1032-J, by C. F. Miller & W. McLean. A Spiral-Beam Method for the Amplitude Modulation of Magnetrons, by J. S. Donal, Jr, & R. R. Bush. The Dyotron—A New Microwave Oscillator, by E. D. McArthur. Electrostatically Focused Radial-Beam Tube, by A. M. Skellett. A New Two-Terminal High-Voltage Rectifier Tube, by G. W. Baker. Titles of other papers are given in other sections.

621.385.1 **2664**

The Valves to be used in the [French] **Receivers of Tomorrow.**—G. Giniaux. (*T.S.F. pour Tous*, Feb. & March 1948, Vol. 24, Nos. 232 & 233, pp. 29–30 & 65–69.) Detailed characteristics and suitable circuits for the following valves : triode-hexode UCH41, pentode UF41, diode-pentode UAF41, and l.f. output pentode UL41. See also 603 of February.

621.385.3 **2665**

On the Limiting Wavelength generated by a Triode.—L. A. Kotomina. (*Radiotekhnika, Moscow*, Jan./Feb. 1948, Vol. 3, No. 1, pp. 51–65. In Russian.) The effects of the following factors on the limiting wavelength are discussed : electron inertia, virtual cathode, output impedance of the valve, geometrical and electron-optical non-uniformities and cathode parameters.

621.385.3 : 621.396.615.17 **2666**

A Developmental Pulse Triode for 200 kW Output at 600 Mc/s.—L. S. Nergaard, D. G. Burnside & R. P. Stone. (*Proc. Inst. Radio Engrs, W. & E.*, March 1948, Vol. 36, No. 3, pp. 412–416.) Detailed account of the A-2212 cylindrical triode and its performance.

621.385.4 **2667**

Space-Charge Tetrode Amplifiers.—N. Pickering. (*Electronics*, March 1948, Vol. 21, No. 3, pp. 96–99.) The performance of the valves noted in 608 of February (Brian) is compared with that of 6K6 pentodes, 6V6 beam tetrodes and Type 45 triodes, in push-pull output stages of high-quality amplifiers. The space-charge valves have a better performance and require less costly components and simpler circuits.

621.385.4 : 537.58 **2668**

Space-Charge Effects in Beam Tetrodes and Other Valves.—C. S. Bull. (*J. Instn elect. Engrs*, Part III, Jan. 1948, Vol. 95, No. 33, pp. 17–24.) The space charge in the screen/anode space of a beam tetrode is examined, taking into account the effect of electrons returned from the virtual cathode into the grid/cathode region. It is found that, as with previous simpler theories, three theoretically possible charge distributions may be set up ; the one which always occurs in practice, and which has a virtual cathode at a fixed point between the screen and anode, corresponds to the principle of least action. A simple theory of the effect of perturbations is developed, and it is considered unlikely that such perturbations could explain why the virtual-cathode distribution is always set up. The theory is applied to fluctuations of the space-charge-limited current in diodes and triodes.

621.385.832 **2669**

Improvements in the Construction of Cathode-Ray Tubes.—J. de Gier & A. P. van Rooy. (*Philips tech. Rev.*, 1947, Vol. 9, No. 6, pp. 180–184.) Describes the reduction in deflection defocusing, flattening of the screen and other improvements possible for a c.r. tube of a given length when a flat glass base with sealed-in pins is used instead of a cap and glass pinch. The introduction of screening between X and Y deflector plates and leads, and the fixing of electrodes into sintered glass contained in ceramic rods, are also discussed.

621.396.615.141.2 **2670**

Pinhole Radiography of Magnetrons.—R. Dunsmuir, C. J. Milner & A. J. Spayne. (*Nature, Lond.*, 14th Feb. 1948, Vol. 161, No. 4085, pp. 244–245.) Pinhole radiographs have been taken along the axis of a 2 000-kW pulsed magnetron for λ 10 cm, operated at an anode voltage of 47 kV. The results are discussed and show that the method can give valuable information about electron motion in magnetrons.

621.396.615.141.2 **2671**

A Magnetron-Resonator System.—E. C. Okress. (*J. appl. Phys.*, Dec. 1947, Vol. 18, No. 12, pp. 1098–1109.) The mode of operation of a vane-type magnetron is analysed by first considering the mutual coupling between cavities in a hypothetical linear structure with an infinitely long anode, and then applying the findings to the practical case of a cylindrical structure. The treatment results in reasonably accurate predictions of the wavelength for the π-mode. The function of straps is also discussed.

621.396.615.142.2 **2672**

Considerations on the Electronic Tuning Band and the Useful Output of Reflex Klystrons.—G. Vincent. (*Ann. Radioélect.*, Jan. 1948, Vol. 3, No. 11, pp. 21–28.) Using results obtained by Bernier (2990 of 1947), formulae for the tuning bandwidth and the output are obtained in terms of the Q of the cavity and for conditions approximating to normal practice. A general equation is derived from which the operating frequency can be found and also the matching conditions and reflector voltage giving the maximum useful output. The variations of the electronic tuning bandwidth for maximum output conditions are expressed in terms of the different operational and control parameters of the valve.

621.396.694.032.42 **2673**

An Improved Method for the Air-Cooling of Transmitting Valves.—H. de Brey & H. Rinia. (*Philips tech. Rev.*, 1947, Vol. 9, No. 6, pp. 171–178.) A system enabling air-cooling to be used for valves at present water-cooled. The cooling air, instead of being blown along the whole length of the anode and thus cooling one end less than the other, is split into several streams by a specially designed air distributor, each stream cooling a small section of the anode.

MISCELLANEOUS

058 : 621.001 **2674**

Almanach des Sciences, 1948.—L. de Broglie (Ed.). A general review of progress in various branches of science, and a directory of French scientific research establishments, indicating the address, telephone number, and key personnel of each. A list of scientific periodicals, with publishers' names and addresses, is also given. For corresponding British information see 1527 of May.

53 Planck **2675**

Prof. Max Planck.—H. T. Flint. (*Nature, Lond.*, 3rd Jan. 1948, Vol. 161, No. 4079, pp. 13–15.) Review of his life and work. See also 1841 of June (de Broglie).

621.3(083.74) **2676**

Standard Terms and Abbreviations.—A. Edwards: F. S. G. Scott. (*Wireless Engr*, June 1948, Vol. 25, No. 297, p. 198.) Comment by Edwards on 2426 of August (G.W.O.H.). Scott, as author of 'Absolute Bels' (2436 of 1946) protests against Odell's remarks (2428 of August).

621.38/.39 **2677**

1948 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs, W. & E.*, March 1948, Vol. 36, No. 3, pp. 365–380.) Abstracts are given of 130 papers presented at the Convention, including:—Health Physics Problems in Atomic Energy, by K. Z. Morgan, and Statistical Methods in the Design and Development of Electronic Systems, by L. S. Schwartz. For titles of the other 128 papers, see other sections. For another brief general account of the Convention, see *Electronics*, May 1948, Vol. 21, No. 5, pp. 72–75.

621.396 **2678**

Telecommunications Research.—(*Electrician*, 28th May 1948, Vol. 140, No. 3650, pp. 1644–1646; *Elect. Rev., Lond.*, 4th June 1948, Vol. 142, No. 3680, pp. 901–902.) A short account of the development of the Telecommunications Research Establishment, commonly referred to as T.R.E., at Great Malvern, Worcestershire. The work of the various sections of the establishment is reviewed and particulars are given of the School of Electronics recently opened for training apprentices, who will later become either craftsmen instrument makers or professional engineers.

621.396(47) **2679**

Russian Radio, 1917-1947.—(*Radiotekhnika, Moscow*, Nov./Dec. 1947, Vol. 2, No. 8, pp. 3–64. In Russian.) A jubilee number containing 12 articles and reviewing the progress made in various branches of radio science and engineering.

621.396 **2680**

Radio Handbook. [Book Review]—R. L. Dawley (Ed.). Editors and Engineers Ltd, Santa Barbara, 11th edn 1947, 512 pp., $3.25. (*Electronics*, April 1948, Vol. 21, No. 4, pp. 252, 254.) "An eminently useful book for hams as well as for any practising radio communications engineer."

621.396 **2681**

Introduction to Wireless. [Book Notice]—W. F. Pearce. G. Bell & Sons, London, 247 pp., 7s. 6d. (*Wireless Engr*, June 1948, Vol. 25, No. 297, p. 197.)

621.396.029.64 **2682**

Theory and Application of Microwaves. [Book Review]—A. B. Bronwell & R. E. Beam. McGraw-Hill Publishing Co., London, 470 pp., 36s. (*Wireless Engr*, May 1948, Vol. 25, No. 296, p. 163.) Excellently produced and liberally illustrated. The engineering point of view is stressed throughout and, wherever possible, analytical results are expressed in a form convenient for engineering use. "A better balance could have been maintained in the selection of the subject matter."

621.396.029.64 **2683**

Microwave Technique. [Book Review]—Radio Society of Great Britain, 54 pp., 2s. (*Electronic Engng*, April 1948, Vol. 20, No. 242, p. 135.) "An admirable introduction to the principles and practice of radio techniques used in the frequency range 3 000–30 000 Mc/s."

ABSTRACTS and REFERENCES

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to it.

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ACOUSTICS AND AUDIO FREQUENCIES

016 : 534 **2684**

References to Contemporary Papers on Acoustics.—A. Taber Jones. (*J. acoust. Soc. Amer.*, May 1948, Vol. 20, No. 3, pp. 350–355.) Continuation of 2118 of August.

534.213 : 532.584 **2685**

The Absorption of Sound in Suspensions of Irregular Particles.—R. J. Urick. (*J. acoust. Soc. Amer.*, May 1948, Vol. 20, No. 3, pp. 283–289.) For small spherical particles, the greater part of the absorption can be attributed to the viscous drag between the fluid and the particles in the sound field; the absorption thus found agrees with that obtained otherwise by Lamb. Experimental results for suspensions of irregular particles of sand and kaolin, obtained by a pulse-reflection method at megacycle frequencies, agree approximately with the idealized theory as the particle size, viscosity and frequency, are varied.

534.23/.24 **2686**

Reflection and Transmission of Sound by a Spherical Shell.—J. B. Keller & H. B. Keller. (*J. acoust. Soc. Amer.*, May 1948, Vol. 20, No. 3, pp. 310–313.) A modification of Rayleigh's method for the reflection of a plane wave by an infinite plate of finite thickness is applied to obtain an exact solution for a spherical shell with the sound source at the centre. Agreement is obtained with the results of Primakoff & Keller (912 of April).

534.241 : 534.213 **2687**

Reflection of Sound from Coastal Sea Bottoms.—L. N. Liebermann. (*J. acoust. Soc. Amer.*, May 1948, Vol. 20, No. 3, pp. 305–309.) Values of the reflection coefficient were obtained experimentally for ultrasonic waves at grazing incidence. The reflection coefficient appears to depend on the average and relative size of the particles of the sea bed, and on bottom topography.

534.321.9 : 538.569.4 : 546.212 **2688**

The Origin of Ultrasonic Absorption in Water.—Hall. (*See* 2774.)

534.78 **2689**

Effects of High Pass and Low Pass Filtering on the Intelligibility of Speech in [fluctuation] **Noise.**—I. Pollack. (*J. acoust. Soc. Amer.*, May 1948, Vol. 20, No. 3, pp. 259–266.) Discussion of articulation tests, using speech of limited frequency range, in the presence of fluctuation noise having a level of 81.5 db above 0.000 2 dyne/cm^2. The Bell Telephone Laboratories' method for computing the articulation index was found to be adequate for assessing the efficiency of communication systems. The relative contribution of the higher speech frequencies to the articulation increased with the intensity level of the speech signal.

534.78 **2690**

Speech Communication under Conditions of Deafness or Loud Noise.—W. G. Radley. (*J. Instn elect. Engrs*, Part I, May 1948, Vol. 95, No. 89, pp. 201–212. Discussion, pp. 212–216.) A theoretical study indicates that when speech has to be very loud in order to be distinguished, the greatest intelligibility can usually be expected if the amplification varies with frequency in a manner indicated graphically by J. O. Ackroyd in an appendix. This was confirmed by tests on a large number of deaf people.

The noise level in some armoured fighting vehicles, and the effectiveness of ear pads in excluding the noise, are discussed. The overall amplification/frequency characteristics of the intercommunication and R/T systems for such vehicles are considered. For optimum results the response should have no sudden changes with frequency.

534.833.4 **2691**

Absorption-Frequency Characteristics of Plywood Panels.—P. E. Sabine & L. G. Ramer. (*J. acoust. Soc. Amer.*, May 1948, Vol. 20, No. 3, pp. 267–270.)

534.851 **2692**

Balanced Clipper Noise Suppressor.—S. L. Price. (*Audio Engng, N.Y.*, March 1948, Vol. 32, No. 3, pp. 13–16, 37.) Design details of a circuit for the suppression of surface noise without any sacrifice of high-frequency fidelity. Development work is discussed and a diagram is given of the circuit finally adopted, with a frequency-response curve for normal suppression at maximum output. See also 3006 of 1947 (Scott) and 1233 of May (Goodell).

534.851 : 621.396.645.029.3 : 621.395.813 **2693**

An Amplifier and Noise Suppressor Unit.—Scott & Dyett. (*See* 2759.)

534.851.6 **2694**

Misconceptions about Record Wear.—N. C. Pickering. (*Audio Engng, N.Y.*, June 1948, Vol. 32, No. 6, pp. 11–14, 47.) For minimum record wear a highly compliant pickup of low moving mass and with a highly polished diamond stylus is preferable. Arm friction and turntable vibration should be avoided and tracking pressure should be low. Some improvement can be effected at the expense of the very high frequencies by introducing compliance between the stylus and the moving system. Lacquer and vinylite disks do not show wear as readily as shellac records, but are much more susceptible to surface dirt and are easily damaged by a worn stylus. Tests indicate that with standard commercial records a stylus radius of 0.003 inch or larger produces more rapid wear than one of radius 0.002 3–0.002 5 inch.

534.86 : 534.322.1 **2695**

Influence of Reproducing System on Tonal-Range Preferences.—H. A. Chinn & P. Eisenberg. (*Proc. Inst. Radio Engrs, W. & E.*, May 1948, Vol. 36, No. 5, pp. 572–580.) An investigation of listeners' preferences when the transmission system is compensated for the changes in the response of the ear with loudness level. The main conclusions are :—(*a*) A wide frequency range is not preferred even with a fully compensated system. (*b*) A similar bandwidth is favoured for both uncompensated and compensated systems. (*c*) Bass is preferred to high frequencies in music ; sibilance in speech is disliked. (*d*) Changes other than compensation in the reproducing system do not affect tonal range preferences. See also 3567 of 1945, 612 of 1947, and 1236 of May (Olson).

534.86 : 534.322.1 **2696**

Optimum Frequency Range.—J. Moir. (*Electronic Engng*, March 1948, Vol. 20, No. 241, pp. 98–99.) Discussion of the results of Olson's listener preference tests (10 of January). For earlier work see 1185 of 1947.

534.862.4 : 621.396.665 **2697**

A Modern Sound-Reinforcement System for Theaters.—C. E. Talley & R. W. Kautzky. (*J. Soc. Mot. Pict. Engrs*, Feb. 1948, Vol. 50, No. 2, pp. 149–161.) Description of a system used at the Roxy Theatre, New York, which includes a control console of unusual design, equipped with mixers and volume controls of a new type. Stereophonic reproduction is also discussed.

534.87 **2698**

The Magnetostrictive Radial Vibrator.—L. Camp. (*J. acoust. Soc. Amer.*, May 1948, Vol. 20, No. 3, pp. 289–293.) A vibrator for underwater sound signalling. Operating characteristics are specified. A plastic cast to protect the windings improves rather than decreases the potential efficiency.

534.87 : 621.395.61/.62 **2699**

Characteristics of Stepped-Frequency Transducer Elements.—F. P. Bundy. (*J. acoust. Soc. Amer.*, May 1948, Vol. 20, No. 3, pp. 297–304.) Transducers for underwater signalling made up of elements tuned to slightly different frequencies, to produce a broad response curve, are no more efficient than more heavily damped single-frequency elements. They have also a more irregular frequency and phase response.

534.88(26.03) : 621.396.932 **2700**

Sofar [sound fixing and ranging].—Stifler & Saars. (*See* 2797.)

621.395.61/.62 **2701**

A New Electro-Acoustic Transducer.—G. Bradfield. (*Electronic Engng*, March 1948, Vol. 20, No. 241, pp. 74–78.) Instead of traversing and re-traversing a path of limited length in the transducer, the wave is here generated at a point remote from the ends of the body in which it is propagated ; it gives rise to two waves moving in opposite directions, one of which is propagated freely in the body and does not interfere with the other, which is launched from the end of the body, and can be used for exploration. Apparatus generating such waves is illustrated and described in detail. Its mode of operation is discussed, and oscillograms for various test pieces are included. The apparatus has been applied to determining the thickness of a concrete slab.

621.395.623.7 **2702**

Single-Diaphragm Loudspeakers.—A. C. Barker. (*Wireless World*, June 1948, Vol. 54, No. 6, pp. 217–219.) A composite moving coil is used, consisting of an energized primary coil and a closed-turn secondary energized by induction. The secondary is separated from the primary by a resilient material which permits relative movement at high frequencies. The secondary thus gives improved high-frequency response and provides magnetic damping at low frequencies. An improved type of cone is described.

621.395.623.7 **2703**

The Energy Transformation in Electrodynamic Loudspeakers.—E. Synek. (*Radio Tech., Vienna*, 1947, Vol. 23, Nos. 2/3, pp. 124 et seq. & May 1948, Vol. 24, No. 5, pp. 232–236.) Electromechanical relations are first considered. By transformation of the fundamental equations for cone loudspeakers and by use of electroacoustic analogies, an equivalent system is derived from which the current distribution, the various losses, the radiation and the frequency characteristics are easily obtained. It is found that below the fundamental resonance frequency the radiation falls off very rapidly ; at resonance it has a high maximum and above the resonance frequency it is practically constant throughout a relatively wide frequency band. Nonlinear distortion can be minimized by suitable design and by avoiding overloading. The absolute value of the efficiency and its dependence on frequency are also derived by means of an equivalent system. The efficiency, except for a small range near the resonance frequency, is extraordinarily small, and the current heating losses in the moving coil exceed the radiated acoustic power. For the electrodynamic cone loudspeaker, only increase of the airgap flux can give an appreciable increase of efficiency.

621.395.623.8 **2704**

The Problem of Sound Distribution : Part 1.—O. L. Angevine, Jr, & R. S. Anderson. (*Audio Engng, N.Y.*, June 1948, Vol. 32, No. 6, pp. 18–23.) Discussion of the planning of complete sound systems for speech or music either indoors or outdoors. Graphs assist in determining the loudspeaker power required for assigned intensity levels.

621.395.623.8 **2705**

Three-Way Speaker System.—G. A. Douglas. (*Audio Engng, N.Y.*, June 1948, Vol. 32, No. 6, pp. 15..47.) Two series-type dividing networks are connected in cascade to give low-pass, band-pass and high-pass transmission characteristics suited to the three loudspeakers, with crossovers at 500 and 3 000 c/s. The method of obtaining correct phasing is described briefly.

621.395.625 **2706**

The Recording and Reproduction of Sound : Parts 14-17.—O. Read. (*Radio News*, April–July 1948, Vol. 39, Nos. 4–7, pp. 72–73..120, 60–61..187, 65–67..170 & 52–53..126.) Part 14: Discussion of gramophone pickup tracking error, groove skating and record wear. Part 15: Theory, design and construction of a dynamic noise suppressor unit having standard parts. Part 16: Performance testing of voltage and power amplifiers used in recording units. Part 17: A study of the decibel. For earlier parts see 2441 of September and back references. To be continued.

621.395.625.2 **2707**

Increasing Volume Level in Disc Recording.—E. Cook. (*Audio Engng, N.Y.*, March 1948, Vol. 32, No. 3, pp. 17–20, 38.) The average recorded level can be increased by 6–12 db if two limiting amplifiers working on different parts of the a.f. spectrum are used. The response/frequency characteristic of the recording channel is modified during high-level bursts, giving a marked improvement in apparent dynamic range.

621.395.625.2 : 621.395.667 **2708**

A Bass Correction Circuit for Moving Coil Pickups.—N. Winder. (*Electronic Engng*, June 1948, Vol. 20, No. 244, pp. 187–189.) Complete circuit details, with the calculated response curves, for a pre-amplifier stage. A high-pass circuit, in which $|X_c| = \frac{1}{2}R$ and $|X_L| = R$, is used for negative feedback in the cathode circuit of a pentode valve. The anode waveform is constant down to any given frequency, with a sensibly linear amplitude increase for the lower three octaves or more, according to circuit values. See also 833 of 1946 (Haines).

621.395.625.6 **2709**

Synthetic Sound on Film.—R. E. Lewis & N. McLaren. (*J. Soc. Mot. Pict. Engrs*, March 1948, Vol. 50, No. 3, pp. 233–247.) An analysis of both hand-drawn and machine-made sound tracks.

621.395.667 : 621.396.611.3 **2710**

RC Circuits as Equalizers.—Dahl. (*See* 2742.)

621.395.92 **2711**

The Comparative Performance of an Experimental Hearing Aid and Two Commercial Instruments.—C. V. Hudgins, R. J. Marquis, R. H. Nichols, Jr, G. E. Peterson & D. A. Ross. (*J. acoust. Soc. Amer.*, May 1948, Vol. 20, No. 3, pp. 241–258.) Discussion of systematic articulation tests with hard-of-hearing subjects as listeners. For most listeners, the experimental hearing aid, described in an appendix, was found to be superior to the commercial instruments.

621.396.611 **2712**

A New Electro-Mechanical Oscillator and Resonator.—P. J. Neilson. (*Marconi Rev.*, Jan./March 1948, Vol. 11, No. 88, pp. 14–16.) The resonant properties of a mild steel ring can be used for fundamental or harmonic frequencies above 1 kc/s. A curve is given relating frequency and thickness for a given diameter of annulus. In a particular case the temperature coefficient of frequency was $+ 160 \times 10^{-6}$ per 1°C at 2 550 c/s with a Q value in excess of 1 000.

534.78 **2713**

Visible Speech. [Book Review]—R. K. Potter, G. A. Kopp & H. C. Green. D. Van Nostrand, New York & Macmillan, London, 1947, 441 pp., 25s. (*Nature, Lond.*, 6th March 1948, Vol. 161, No. 4088, p. 334.) A detailed treatment of the major results and development to date. "Can be unreservedly recommended to all those who have a specialist's interest in speech sounds, and in particular to those who are intimately concerned with the interests of the deaf."

621.395.92 **2714**

Hearing Aids. [Book Review]—H. Davis, S. S. Stevens, R. H. Nichols, Jr, C. V. Hudgins, R. J. Marquis, G. E. Peterson & D. A. Ross. Harvard University Press, Cambridge, Mass., 1947, 197 pp., $2.00. (*Electronics*, June 1948, Vol. 21, No. 6, pp. 242–243.) The results of war-time work on the adaptation of hearing aids to individual users. Intelligibility tests were conducted on 18 hard-of-hearing men and women; tone quality and ease of listening were not considered. Conclusions from the results do not agree with the general experience of the reviewers.

AERIALS AND TRANSMISSION LINES

621.315 **2715**

On the Theory of a Coaxial Spiral Line.—L. N. Loshakov & E. B. Ol'derogge. (*Radiotekhnika, Moscow*, March/April 1948, Vol. 3, No. 2, pp. 11–20. In Russian.)

621.315.212 : 621.317.333.4 **2716**

Pulse Techniques in Coaxial Cable Testing.—Roberts. (*See* 2842.)

621.315.68.011.2 **2717**

The Characteristic Impedance of Cable Junctions.—P. G. Violet. (*Frequenz*, March 1948, Vol. 2, No. 3, pp. 80–82.) Formulae applicable to coaxial cables are derived.

621.392.029.64 **2718**

Structure of a Wave of Phase Velocity *c*.—A. Abragam (*C. R. Acad. Sci., Paris*, 26th April 1948, Vol. 226, No. 17, pp. 1356–1357.) Theory shows that only waves of phase velocity equal or nearly equal to c (the velocity of light) can impart large amounts of energy to an electron in an ordinary accelerator. Discussion of waves propagated axially in a waveguide shows that waves of phase velocity c cannot, in general, be obtained by combining a TM wave with a TE wave. The properties of waves with phase velocity c are discussed. Transverse effects become negligible for the case of symmetry of revolution.

621.392.029.64 **2719**

Directional Couplers.—W. H. Watson. (*Proc. Inst. Radio Engrs, W. & E.*, May 1948, Vol. 36, No. 5, p. 632.) A basic combination of slots described in 1855 of July (Riblet & Saad) has previously been recorded in the author's publications noted in 1360 and 2689 of 1947.

621.392.029.64 **2720**

Properties and Applications of Waveguides of Oval Section.—M. Jouguet. (*C. R. Acad. Sci., Paris*, 10th May 1948, Vol. 226, No. 19, pp. 1515–1517.) By use of a section of nearly circular waveguide of suitable length and cross-section, a wave with plane polarization can be transformed into a wave of the same type, but with the plane of polarization rotated through any required angle. A plane-polarized wave can also be transformed into one with elliptical polarization of any ellipticity. Applications are described in which these principles are used for the transmission of waves round elbows of any total angle.

The remarkable property that the attenuation of H_0 waves decreases with increase of frequency, does not hold when the waveguide section ceases to be exactly circular, because the least deformation of the cross-section of the waveguide causes a longitudinal wall current to appear, with a consequent attenuation which increases with frequency. See also 2724 below.

621.392.029.64 : 512.831 **2721**

Reflections from Circular Bends in Rectangular Wave Guides — Matrix Theory.—S. O. Rice. (*Bell Syst. tech. J.*, April 1948, Vol. 27, No. 2, pp. 305–349.) A general matrix theory is developed for propagation in waveguides, and applied to E- and H-bends in a guide of rectangular cross-section. The application of the method involves considerable computation. Approximate solutions are derived which apply strictly to large radii of curvature but which appear to be useful for rather sharp bends. These solutions agree with those previously derived by other methods.

621.392.029.64 : 513.3 **2722**

Geometry of Rectangular Waveguides.—A. C. Bartlett. (*Wireless Engr*, July 1948, Vol. 25, No. 298, pp. 202–210.) Discussion of transmission, critical wavelengths, resonant wavelengths, attenuation, H_{0n} and H_{m0} modes, etc., for waveguides in vacuo or containing dissipative dielectric. All results are obtained by simple geometrical constructions based on geometrical properties implied in the standard waveguide formulae and equations.

621.392.029.64 : 621.3.09 **2723**

Note on the Propagation of Electromagnetic Waves in a Cylindrical Waveguide.—R. Rigal. (*Onde élect.*, April 1948, Vol. 28, No. 253, pp. 158–163.) A simplified treatment based on a fundamental theorem, proof of which is given, and on a generalization of the concept of phase velocity. Expressions are derived for the cut-off frequency and the impedance for TM and TE waves. The case of H_{01} waves in a guide of rectangular section is considered briefly.

621.392.029.64 : 621.3.09 **2724**

Wave Propagation in a Guide of Nearly Circular Section.—M. Jouguet. (*C. R. Acad. Sci., Paris*, 3rd May 1948, Vol. 226, No. 18, pp. 1436–1438.) Detailed discussion of the principal and secondary effects of slight deformation of a waveguide from an exactly circular shape shows that all waves resulting from an E_p wave in the circular waveguide, except the E_0 and H_0 waves, are unstable. Numerical calculation shows that the effects of the instability are considerable. As regards the secondary effects, each of the two waves which correspond to a given wave can be regarded as the superposition of a principal wave of the same type and of perturbations of small amplitude. See also 2000 of 1947 and 2720 above.

621.392.029.64.012.8 **2725**

E-Plane Bend.—J. W. Miles. (*Proc. Inst. Radio Engrs, W. & E.*, May 1948, Vol. 36, No. 5, p. 632.) It is admitted that results described in Radiation Laboratory (M.I.T.) Report 43, dated July 2, 1944, are more accurate than those in the author's paper noted in 648 of March.

621.396.67 **2726**

Short Receiving-Antenna Design Factors.—H. Kees. (*Communications*, May 1948, Vol. 28, No. 5, pp. 26–27 . . 35.) Discussion of design problems for aircraft and other aerials with an electrical length less than about 10 ft at standard broadcasting frequencies.

621.396.67 **2727**

Antenna Pattern Measurement.—H. R. Skifter & J. S. Prichard. (*Communications*, March 1948, Vol. 28, No. 3, pp. 26–28 . . 43.) Discussion of various methods and short description of a scale-model system of measurement.

621.396.67 : 517.512.2 **2728**

The Fourier Transform of the Incomplete Gaussian Function.—Millington. (*See* 2833.)

621.396.671 **2729**

Radiation Resistance of an Antenna with Arbitrary Current Distribution.—C. J. Bouwkamp. (*Philips Res. Rep.*, Jan. 1946, Vol. 1, No. 2, pp. 65–76.) The radiation resistance is expressed as the integral of a function which depends in a very simple way on the aerial current distribution. It is thus possible to calculate the radiation without knowledge of the radiation pattern. The formula is applied to many 'classical' cases and the results are compared with those of other authors.

621.396.671 **2730**

The Problem of Optimum Antenna Current Distribution.—C. J. Bouwkamp & N. G. de Bruijn. (*Philips Res. Rep.*, Jan. 1946, Vol. 1, No. 2, pp. 135–158.) La Paz & Miller (2138 of 1943) define the theoretical optimum current distribution in a vertical aerial of given length as that current distribution which gives the maximum possible field strength on the horizon for a given power output. It is shown that this problem of optimum current distribution has no 'exact' solution.

A method is here developed to realize any given vertical radiation pattern by suitable choice of the current distribution. This gives theoretical distributions far better than the 'optimum distributions' of La Paz & Miller. See also 2732 below.

621.396.677 **2731**

Note on the Maximum Directivity of an Antenna.—H. J. Riblet. (*Proc. Inst. Radio Engrs, W. & E.*, May 1948, Vol. 36, No. 5, pp. 620–623.) "It has been shown by Bouwkamp and de Bruijn [2730 above] that the directivity of a linear current distribution of fixed length may be made arbitrarily large. By a slight extension of their arguments, the same conclusion is demonstrated for a two-dimensional current distribution and for a distribution of current on an infinite strip."

621.396.677 : 621.317.733 **2732**

Transmission-Line Bridge.—Westcott. (*See* 2854.)

621.396.679.4 **2733**

Feeding the Beam with Inductively Coupled Loops.—H. E. Stewart. (*CQ*, March 1948, Vol. 4, No. 3, pp. 42–47 . . 70.) The driven element of a parasitic array can be inductively coupled to its transmission line by means of two loops coaxial with the vertical shaft on which the aerial system rotates. The theory of inductive coupling, as applied to aerials, is discussed. This method can also be used as an impedance transforming device. Practical data are included.

CIRCUITS AND CIRCUIT ELEMENTS

621.3.018.12 **2734**

Phase.—"Cathode Ray". (*Wireless World*, May & June 1948, Vol. 54, Nos. 5 & 6, pp. 187–190 & 227–230.) An elementary discussion.

621.392 **2735**

On a Remarkable Property of the Bridged-T Line and its Application to the Calculation of the Powers Distributed in the Branches of this Line.—C. Kafian. (*Radio franç.*, March & April 1948, pp. 18–20 & 11–14.) Methods of calculation of bridged-T lines are usually rather long, or require a knowledge of general network theory. Starting from a Γ line, simple theory shows that for the bridged-T line the potential of the midpoint is equal to the output potential. This property greatly simplifies the calculation of the powers distributed in the different branches of the line. Simple relations between these powers are derived and curves are given from which the maximum power dissipated in the various branches can be found for bridged-T lines with linear attenuation variation.

621.392 **2736**

The Response of a Linear Diode-Voltmeter to Single and Recurrent R.F. Impulses of Various Shapes.—R. E. Burgess. (*J. Instn elect. Engrs*, Part III, March 1948, Vol. 95, No. 34, pp. 106–110.) "The response to a short single impulse of arbitrary shape is evaluated in terms of the time-integral or area of its envelope. The ratio of this area to the peak amplitude is termed the effective duration of the impulse." The response to recurrent impulses whose spacing is small compared with the discharge time-constant is expressed in a general manner; graphs are given for the cases of rectangular and triangular impulses. The 'effective charge time-constant' of the voltmeter depends on impulse and circuit parameters. The rectification efficiency for triangular impulses lies between 0.75 and 1.0 times that for rectangular impulses of the same effective duration and periodicity.

The maximum indication of a critically damped meter corresponding to the rectified voltage produced by the application of a single impulse is evaluated in terms of the ratio of the meter and discharge time-constants.

The damping imposed by the diode rectifier on a sharply tuned circuit is calculated for single and recurrent impulses; it is considerably greater than for continuous waves.

621.392 : 003.62 **2737**

Improving Circuit Diagrams.—L. H. Bainbridge-Bell. (*Electronic Engng*, June 1948, Vol. 20, No. 244, pp. 175–177.) A selection from the recommendations contained in the new edition of Inter-Service Standard Graphical Symbols is given, with comments and illustrative diagrams. See also 2030 of 1947 (Keen), and 3812 of 1947 for which the above U.D.C. would have been preferable.

621.392 : 621.314.2 **2738**

On the Generation of Two Out-of-Phase Voltages.—H. Thiede. (*Funk u. Ton*, May 1948, Vol. 2, No. 5, pp. 219–222.) The conditions are determined for obtaining two voltages of the same amplitude but of different phases, from two in-phase voltages of different amplitudes. The particular case is considered where the amplitudes of the in-phase voltages are proportional to the sine and cosine of an angle.

621.395.665.1 **2739**

Surgeless Volume Expansion.—A. A. Tomkins. (*Wireless World*, June 1948, Vol. 54, No. 6, pp. 234–235.) Description of a circuit using an auxiliary valve which is modulated in parallel with the expander valve by variations of the bias on the suppressor grids. The auxiliary valve screen grid is connected to the expander valve anode and the total current measured at this anode thus remains constant. No distortion was apparent for inputs up to ½ V from 20 to 16 000 c/s.

621.396.611.1 : 517.942.932 **2740**

Forced Oscillations in Nearly Sinusoidal Systems.—M. L. Cartwright. (*J. Instn elect. Engrs*, Part III, March 1948, Vol. 95, No. 34, pp. 88–96; summary, *ibid.*, Part I, May 1948, Vol. 95, No. 89, p. 223.) The behaviour, near resonance, of the solutions of the equation

$$\ddot{v} - (\alpha + \beta v - \gamma v^2)\,\dot{v} + \omega^2 v = E\omega_1^2 \sin \omega_1 t$$

where α/ω, β/ω and γ/ω are small, has been discussed by Appleton, van der Pol and others. A more complete discussion is given of the synchronized and quasi-periodic solutions near resonance, their phases, amplitudes and energy, and also the passage from one stable solution to another as the parameters of the system vary. The phase and amplitude favourable to synchronization are prolonged just before synchronization. This agrees with Appleton's experimental results. Hysteresis also occurs. "The decrease in energy with decrease in detuning is explained by the fact that the phase favourable to synchronization is that which opposes the motion and is prolonged."

621.396.611.21 : 549.514.51 **2741**

Quartz Crystals.—Fielding. (*See* 2812.)

621.396.611.3 : 621.395.667 **2742**

RC Circuits as Equalizers.—H. M. Dahl. (*Audio Engng, N.Y.*, June 1948, Vol. 32, No. 6, pp. 16–17.) A simplified method of computing the values of circuit components to give the required response curve.

621.396.611.4 **2743**

Resonant Cavities.—A. V. J. Martin. (*Radio tech. Dig., Édn franç.*, April 1948, Vol. 2, No. 2, pp. 69–83.) General discussion, with formulae for resonance frequency, *Q*, and shunt impedance for various types of cavity.

621.396.615 **2744**

A Selsyn Driven V.F.O.—R. V. McGraw. (*CQ*, March 1948, Vol. 4, No. 3, pp. 17–20..92.) A remote-controlled variable-frequency master oscillator which is sufficiently well screened for simultaneous operation with a receiver on the same frequency. This enables the transmitter to be keyed at a stage following the oscillator, with a consequent improvement in the keyed waveform.

621.396.615.17 **2745**

Milli-Microsecond Pulse Generation by Electron Bunching.—J. B. Hasted. (*Proc. phys. Soc.*, 1st April 1948, Vol. 60, No. 340, p. 397.) Details of a method for producing pulses of duration 10^{-9} sec or less by bunching electrons with alternating voltages of frequency 210 Mc/s. The electronic arrangement consists essentially of a klystron in which the resonant catcher is replaced by a non-resonant collector in the form of a coaxial line. Satisfactory agreement is found between experimental results and Harrison's mathematical theory of electron bunching (617 of February). The theoretical pulse width is of the order of 2×10^{-10} sec, with spacing about 5×10^{-9} sec. It is hoped to verify these figures with viewing equipment. The device is expected to be capable of supplying pulses of variable width and of duration short enough for testing wide-band coincidence counting circuits.

621.396.615.17 **2746**

Linear Saw-Tooth Generators.—A. W. Keen. (*Wireless Engr*, July 1948, Vol. 25, No. 298, pp. 210–214.) By including a constant-current charging valve in the discharge-circuit loop, a circuit is obtained whose linearity and flyback time are satisfactory over a wide frequency range. Only two valves are required. The charging valve assists the discharge valve during the flyback period.

621.396.615.17 **2747**

Multivibrator Step-Down by Fractional Ratios.—K. H. Davis. (*Bell Lab. Rec.*, March 1948, Vol. 26, No. 3, pp. 114–118.) Step-down by rational ratios such as 1789 : 121 is possible by application of feedback to multi-stage multivibrators. Typical circuits are analysed.

621.396.615.17 : 518.4 **2748**

Multivibrator Design by Graphic Methods.—A. E. Abbot. (*Electronics*, June 1948, Vol. 21, No. 6, pp. 118–120.) Curves are given for commonly used valves. All phenomena affecting circuit operation are taken into account.

621.396.615.17 : 621.317.755 **2749**

Improving Fly-Back Time on a Miller Timebase.—V. Attree. (*Electronic Engng*, March 1948, Vol. 20, No. 241, p. 97.) By means of a cathode follower, flyback time may be reduced by a factor of approximately 100 for sweep durations greater than 1 ms.

621.396.615.17 : 621.317.755 **2750**

A Linear Hard-Valve Time-Base for Oscilloscopes.—(*Radio & Electronics, Wellington, N.Z.*, 1st April 1948, Vol. 3, No. 1, pp. 4–8, 48.) A 3-valve timebase unit which generates an accurately linear sweep. The ratio of fly-back time to sweep time is independent of the sweep frequency.

621.396.619.13 **2751**

Factors affecting the Frequency Deviation in Reactance-Tube Frequency Modulation Circuits.—Chai Yeh & Y. K. Tz'u. (*Chin. J. Phys.*, Dec. 1947, Vol. 7, No. 2, pp. 72–80.) Theoretical discussion of the frequency deviation of both inductive and capacitive circuits as affected by the phase-shift constants and the L/C ratio of the oscillator tank circuit. Experimental results are in fair agreement with theory.

621.396.645 **2752**

Constant Amplification in spite of Changeability of the Circuit Elements.—J. J. Zaalberg van Zelst. (*Philips tech. Rev.*, 1947/1948, Vol. 9, No. 10, pp. 309–315.) Methods of making the amplification depend very little on valve slope were discussed in 3063 of 1947. Here the problem of keeping amplification constant within limits narrower than the tolerances of other variable circuit elements is solved similarly. Circuits can thus be made with an amplification per valve of, say, 8 ± 1% for a tolerance of ± 5% in component ratings. A number of such stages can be used in cascade.

621.396.645 **2753**

Wide-Band Amplification.—L. Ratheiser. (*Radio Tech., Vienna*, May 1948, Vol. 24, No. 5, pp. 200–204.) Discussion of (*a*) direct and (*b*) carrier-frequency amplification, with design methods for practical amplifiers and charts for determining the numerical values of circuit components.

621.396.645 **2754**

Wide-Band Power Amplifiers.—J. A. Hodelin. (*Radio franç.*, April 1948, pp. 20–25.) Discussion of (*a*) voltage amplification and compensation circuits ; (*b*) counter-reaction and its use for distortion reduction, stability improvement, increase of bandwidth and decrease of the internal resistance viewed from the output terminals ; (*c*) transformer and cathode-follower output stages.

621.396.645 **2755**

High Quality Amplifier with the 6AS7G.—C. G. McProud. (*Audio Engng, N.Y.*, March 1948, Vol. 32, No. 3, pp. 21–24.) The twin-triode 6AS7G is briefly discussed ; a circuit diagram and performance details are given which show that this valve is an ideal substitute for a pair of conventional valves in the output stage of an amplifier. See also 2756 below.

621.396.645 **2756**

General Purpose 6AS7G Amplifier.—C. G. McProud. (*Audio Engng, N.Y.*, June 1948, Vol. 32, No. 6, pp. 24–29.) Modifications of the amplifier referred to in 2755 above are described, to provide bass and treble tone controls, a dynamic noise suppressor of a modified Scott type (932 of April), a high-gain input stage, and connections for a recorder. Unit construction makes the instrument readily adaptable.

621.396.645 : 537.533.9 **2757**

Insulator amplifies Current 500 Times.—(*Tele-Tech*, March 1948, Vol. 7, No. 3, pp. 72, 74.) A method of controlling the flow and amplification of electric current, based on the discovery that when beams of electrons are shot at an insulator, such as a diamond chip, electric currents are produced which may be 500 times as large as the current in the original electron beam. See also *Electronics*, April 1948, Vol. 21, No. 4, pp. 140, 172, and 2575 of September.

621.396.645.011.2 **2758**

Shunted-Amplifier Input Admittance.—A. Shadowitz. (*Elect. Commun.*, Dec. 1947, Vol. 24, No. 4, pp. 468–477.) A method of calculating the admittance is given, and several cases are worked out for a shunting capacitance. "Application to a frequency modulator is given in detail. Extensions are indicated to the theory of the tuned-plate tuned-grid oscillator, multivibrator, and negative-impedance devices."

621.396.645.029.3 : 534.851 : 621.395.813 **2759**

An Amplifier and Noise-Suppressor Unit.—H. H. Scott & E. G. Dyett, Jr. (*FM & Televis.*, March 1948, Vol. 8, No. 3, pp. 28–30 . . 44.) Discussion of the performance and characteristics of a 20-W a.f. amplifier for use with the Scott noise suppressor (991 of 1947 and 932 of April). The response is within the proposed R.M.A. limits for the audio equipment of f.m. or a.m. broadcast transmitters. A preamplifier is built in, the response of which is designed to equalize the output of magnetic pickups.

621.396.645.371 **2760**

Quiet High-Gain Amplifier.—C. C. Whitehead. (*Wireless World*, June 1948, Vol. 54, No. 6, pp. 208–210.) A push-pull a.f. amplifier with tone control by negative feedback.

621.396.662 **2761**

Wavechanging and Tuning in Receivers between 30 and 180 Mc/s.—L. R. Head. (*Marconi Rev.*, Jan./March 1948, Vol. 11, No. 88, pp. 9–13.) Discussion of various factors, such as stray inductance, which affect the range of frequency available with a given tuning capacitor.

621.396.662 **2762**

Theory and Design of a Cavity Attenuator.—J. J. Freeman. (*Bur. Stand. J. Res.*, March 1948, Vol. 40, No. 3, pp. 235–243.) The fields generated by an arbitrary current distribution exciting a piston-type or cavity attenuator are developed, and symmetrical distributions exciting maximum amplitudes of the dominant mode and minimum amplitudes of unwanted modes are investigated. The relative error in voltage measurement due to spurious modes is computed as a function of spacing between exciting and receiving coils for certain simple current distributions. The relative merits of circular and rectangular attenuator cross-sections are discussed.

621.396.69 **2763**

Operating Characteristics of Film Resistors.—J. Marsten & A. L. Pugh, Jr. (*Tele-Tech*, March 1948, Vol. 7, No. 3, pp. 46–48 . . 84.) Long summary of paper read at the Bureau of Standards Symposium on Printed Circuits. See also 1614 of June (Murray).

621.396.813 : 621.392.015.3 **2764**

Phase and Amplitude Distortion in Linear Networks.—M. J. DiToro. (*Proc. Inst. Radio Engrs, W. & E.*, May 1948, Vol. 36, No. 5, p. 623.) Corrections to 1901 of July.

621.397.645 : 621.397.62 **2765**

Selectivity in Television Amplifiers : Problems of Sound-Channel Rejection.—Cocking. (*See* 2952.)

621.397.645.371 **2766**

The Steady-State and Transient Analysis of a Feedback Video Amplifier.—J. H. Mulligan, Jr, & L. Mautner. (*Proc. Inst. Radio Engrs, W. & E.*, May 1948, Vol. 36, No. 5, pp. 595–610.) Analysis of transient and steady-state phenomena, and of the connection between them, for a 2-stage amplifier. Design curves are given which determine the necessary amplifier parameters when (*a*) the percentage transient overshoot is given, together with either the rise time or the net gain, or (*b*) the overshoot in the steady-state characteristic is given, together with either the frequency for 3-db attenuation or the mid-band gain.

GENERAL PHYSICS

535.317.6 **2767**

Optical Aberrations in Lens and Mirror Systems.—W. de Groot. (*Philips tech. Rev.*, 1947/1948, Vol. 9, No. 10, pp. 301–308.) The principal (third-order) aberrations of large-aperture optical systems in general and of the spherical mirror in particular are discussed. All these aberrations, except field curvature, can be eliminated by means of an aspherical correction plate such as that used in the Schmidt system.

537.311.31.029.64 **2768**

The Conductivity of Metals at Microwave Frequencies.—A. B. Pippard, G. E. H. Reuter & E. H. Sondheimer. (*Phys. Rev.*, 15th April 1948, Vol. 73, No. 8, pp. 920–921.) Criticism of 1345 of May (Serin). The problem is shown to be more complex than is there suggested; a critical value exists for the mean free path of an electron, above which no wave propagation can take place. Different solutions apply to the two regions separated by the critical value.

537.311.4 : 539.23 : 621.315.59 **2769**

The Influence of Surface Films on the Electrical Behaviour of Contacts.—C. C. Dilworth. (*Proc. phys. Soc.*, 1st April 1948, Vol. 60, No. 340, pp. 315–325.) The variation of current with voltage at an idealized contact between two crystals of a semiconductor is calculated on the assumption that electrons penetrate the surface barrier by tunnel effect. Comparison with experimental curves for silicon carbide powders leads to the conclusion that these crystals are covered by an insulating surface film. The existence of such a film affects the rectifying properties of the crystal when it is in contact with a metal. It is shown that this can account for the discrepancies observed between experimental curves and those deduced from the simple Schottky theory of rectification.

537.525.83 **2770**

The Contraction Phenomenon in a Neon Glow Discharge with Molybdenum Cathode.—F. M. Penning & J. H. A. Moubis. (*Philips Res. Rep.*, Jan. 1946, Vol. 1, No. 2, pp. 119–128.)

537.533.9 : 621.396.645 **2771**

Insulator amplifies Current 500 Times.—(*See* 2757.)

538.566 **2772**

A Note on Singularities occurring at Sharp Edges in Electromagnetic Diffraction Theory.—C. J. Bouwkamp. (*Physica, 'sGrav.*, 1946, Vol. 12, pp. 467–474; summary in *Philips Res. Rep.*, Oct. 1947, Vol. 2, No. 5, p. 351.) Wave functions u describing diffraction by plane screens can be divided into two classes according as u or $\partial u/\partial n$ vanishes at the surface of the screen. Differentiation with respect to the coordinate n normal to the screen alters the character of the wave function, but tangential differentiation does not. Differentiation also produces singularities at the edge of the screen. Difficulties in e.m. diffraction theory are discussed, with particular reference to solutions by Sommerfeld and Möglich.

538.566 **2773**

Spherical Waves from a Plane Boundary dividing Two Media.—L. Brekhovskikh. (*Zh. tekh. Fiz.*, April 1948, Vol. 18, No. 4, pp. 455–472. In Russian.)

538.569.4 : 534.321.9 : 546.212 **2774**

The Origin of Ultrasonic Absorption in Water.—L. Hall. (*Phys. Rev.*, 1st April 1948, Vol. 73, No. 7, pp. 775–781.) The suggested theory relates the absorption in a liquid to the molecular states of packing. Acoustic compression causes some molecules to alter their arrrangement, and a time lag in this process causes absorption. The use of this theory to explain the excess absorption in water leads to reasonable agreement with experimental data

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

521.15 : 538.12 **2775**

Magnetic Field of Massive Rotating Bodies.—H. T. H. Piaggio. (*Nature, Lond.*, 20th March 1948, Vol. 161, No. 4090, p. 450.) Blackett (3112 of 1947) has suggested that a satisfactory explanation of the proportionality between the magnetic moment and angular momentum of massive rotating bodies would not be found except within the structure of a unified field theory. J. Mariani claims to have provided such an explanation and theory in his 'Théorie des champs macroscopiques'. Application of the theory to massive rotating bodies gives the desired proportionality between magnetic moment and angular momentum, the earth being supposed to have a positive volume charge compensated by a negative surface charge. The constant of proportionality for the earth, the sun, and the milky way is of the right order of magnitude. Short papers by Mariani have appeared in *C. R. Acad. Sci., Paris*, 1938, Vol. 206, p. 1247; 1940, Vol. 211, p. 430; 1944, Vol. 218, pp. 447 & 855; and in *Cahiers de Physique Théorique, Paris*, Part 1, 1945; see also 1927 of July.

521.15 : 538.12 : 538.71(24.084) **2776**

On the Magnetic Field inside the Earth.—A. Gião. (*C. R. Acad. Sci., Paris*, 19th April 1948, Vol. 226, No. 16, pp. 1298–1300.) Calculations based on the author's theory (1634 of June and back references) lead to formulae which show that while the horizontal component H of the earth's field decreases with depth, the vertical component V increases. Formulae are given showing the increases to be expected for V in the Transvaal and in Lancashire.

523.16 : 621.396.822 **2777**

Radio Noise of Extra-Terrestrial Origin and its Effect on the Technique of Telecommunications.—G. Lehmann. (*Onde élect.*, April & May 1948, Vol. 28, Nos. 253 & 254, pp. 164–172 & 200–205.) The work of Jansky, Grote Reber, Appleton, Southworth and Dicke is reviewed. The fundamental principles of thermodynamics necessary for interpreting the results are recalled, noise factor is defined and a particular method of measuring it is described. The performance of actual u.h.f. receivers is compared with that which would be theoretically possible.

523.53 **2778**

Radio and Meteorites.—R. Jouaust. (*Onde élect.*, April 1948, Vol. 28, No. 253, pp. 150–157.) Discussion of radio methods of observation and of the experimental results of many investigators. Theory does not at present account for all the facts.

523.53 : 621.396.96 **2779**

Radio Echo Observations of Meteors.—J. P. M. Prentice, A. C. B. Lovell & C. J. Banwell. (*Mon. Not. R. astr. Soc.*, 1947, Vol. 107, No. 2, pp. 155–163.) The apparatus used is briefly described and the results obtained during the period June–August 1946 are discussed. For λ 4.2 m, good correlation with observed meteors was obtained for echoes lasting longer than 0.5 sec. Data are included for the daily rate of occurrence and an approximate quantitative relationship is established between meteoric ionization and echo amplitude. See also 411 of February (Hey & Stewart) and 2780–2782 below.

523.53 : 621.396.96 **2780**

Radio Echo Observations of the Giacobinid Meteors 1946.—A. C. B. Lovell, C. J. Banwell & J. A. Clegg. (*Mon. Not. R. astr. Soc.*, 1947, Vol. 107, No. 2, pp. 164–175.) An account of observations, on λ 4.2 m, of the echoes produced by the meteor shower of 10th October 1946. Simultaneous visual observations were obtained for 21 of these echoes. The height distribution, duration and amplitude of the echoes are discussed. A 96% decrease in the number of echoes was noted when the radio beam was directed into the radiant. See also 2779 above, 2781 and 2782 below.

523.53 : 621.396.96 **2781**

Radar Observations of the Giacobinid Meteor Shower, 1946.—J. S. Hey, S. J. Parsons & G. S. Stewart. (*Mon. Not. R. astr. Soc.*, 1947, Vol. 107, No. 2, pp. 176–183.) An account of observations on λ 5 m. A mean value for the geocentric velocity of 22.9 km/sec has been deduced from the analysis of 22 tracks. The characteristics of the stronger echoes are outlined. See also 2779 and 2780 above, and 2782 below.

523.53 : 621.396.96 **2782**

Characteristics of Radio Echoes from Meteor Trails: Part 1 — The Intensity of the Radio Reflections and Electron Density in the Trails.—A. C. B. Lovell & J. A. Clegg. (*Proc. phys. Soc.*, 1st May 1948, Vol. 60, No. 341, pp. 491–498.) Formulae are derived for the intensity of reflected radiation assuming the electrons to be created in a long narrow column, of diameter small compared with the wavelength of the incident radiation. Experimental work is described which confirms the predicted variation of received power for λ 4.2–8.3 m, and also, according to preliminary results, for λ 1.4–4.2 m. The electron density in the trail can be deduced. See also 2779–2781 above.

523.72.029.6 : 621.396.822 **2783**

Solar Radiation in the Radio Spectrum: Part 1 — Radiation from the Quiet Sun.—D. F. Martyn. (*Proc. roy. Soc. A*, 22nd April 1948, Vol. 193, No. 1032, pp. 44–59.) Theory of the emission of thermal radiation from the solar envelope is developed. The Lorentz theory of absorption is used in conjunction with Kirchhoff's law to derive the effective temperature of the various regions of the solar disk over the radio spectrum. A maximum effective temperature approaching 10^6°K is found near λ 1 m.

523.72.029.6 : 621.396.822 **2784**

An Investigation of Radio-Frequency Radiation from the Sun.—M. Ryle & D. D. Vonberg. (*Proc. roy. Soc. A*, 22nd April 1948, Vol. 193, No. 1032, pp. 98–120.) Measurements of solar radiation at frequencies of 175 Mc/s and 80 Mc/s are described. Special aerials and receiving equipment enabled solar radiation to be recorded separately from the galactic radiation, and also eliminated errors due to variation of receiver gain or internal noise. The results obtained indicate an equivalent surface temperature of the order of 10^6°K, but values as high as 10^8–10^9°K have been observed during the passage of large sunspots. Measurements of the diameter of the source, by a method analogous to Michelson's stellar interferometer, show that during periods of very great intensity the radiation originates in an area comparable with that of a sunspot. During periods of increased activity the radiation is mainly circularly polarized. See also 96 of January.

523.75 **2785**

On the Structure of the Solar Corona and Chromosphere.—H. Bondi, F. Hoyle & R. A. Lyttleton. (*Mon. Not. R. astr. Soc.*, 1947, Vol. 107, No. 2, pp. 184–210.) The existence of the solar atmosphere is explained on the assumption of the accretion of interstellar material arriving at the sun with a high energy per unit mass. The steady state of this atmosphere is examined mathematically. The nature of non-steady states is also discussed with particular reference to prominences and other features of the solar atmosphere. See also 2409 of 1947 (Waldmeier).

523.75 **2786**

Granulation, Magneto-Hydrodynamic Waves, and the Heating of the Solar Corona.—H. Alfvén. (*Mon. Not. R. astr. Soc.*, 1947, Vol. 107, No. 2, pp. 211–219.)

537.591 **2787**

Cosmic Rays: Parts 1 & 2.—C. W. Hewlett. (*Gen. elect. Rev.*, March & May 1948, Vol. 51, Nos. 3 & 5, pp. 11–16 & 23–31.) A concise account of the various types of cosmic rays and their properties, with methods of investigation and discussion of possible explanations of their origin.

550.384 + 550.37 **2788**

Electrical and Magnetic Effects of Marine Currents.—(*Observatory*, April 1948, Vol. 68, No. 843, pp. 55–59.) Report of a Royal Astronomical Society discussion. Measurements of the variation of the vertical component of the earth's magnetic field on opposite sides of a water channel indicate that short-period fluctuations are due to electric currents flowing in the earth, the water channel providing a low-resistance path. Measurements of the electric potential gradient produced in tidal streams by the vertical component are also described.

550.384 "1941.06" **2789**

A Distinctive Geomagnetic Epoch, 1941 June 9-14.—H. W. Newton. (*Observatory*, April 1948, Vol. 68, No. 843, pp. 60–65.) Description of some world-wide sudden commencements that occurred in June 1941, between the two intense geomagnetic storms of March and September.

550.384.4 **2790**

Daily Variation of the Horizontal Magnetic Force at the Magnetic Equator.—J. Egedal. (*Nature, Lond.*, 20th March 1948, Vol. 161, No. 4090, pp. 443–444.) Discussion of the unusually large variations observed at Huancayo and Kodaikanal. See also 1936 of July.

551.508.94 : 621.317.32 **2791**

A Radiosonde Method for Atmospheric Potential Gradient Measurements.—Belin. (*See* 2840.)

551.510.52 **2792**

On the Ionic Equilibrium of the Lower Atmosphere.—J. Bricard. (*C. R. Acad. Sci., Paris*, 10th May 1948, Vol. 226, No. 19, pp. 1536–1538.) Theoretical treatment, with derivation of a formula for the intensity of ionization.

621.317.792 **2793**

A Lightning Warning Device.—B. F. J. Schonland & P. G. Gane. (*Trans. S. Afr. Inst. elect. Engrs*, Feb. 1948, Vol. 39, Part 2, pp. 58–59.) Discussion on 3987 of 1947. R. Davis calls attention to a somewhat similar device noted in 3138 of 1946. See also 2794 below.

621.317.792 **2794**

The Ceraunometer.—P. G. Gane & B. F. J. Schonland. (*Weather, Lond.*, June 1948, Vol. 3, No. 6, pp. 174–178.) A device to record the number of lightning discharges within a given radius. See also 3987 of 1947 and 2793 above.

551.510.535 + 551.594.5 **2795**

Ionospheric Research at College, Alaska, July 1941-June 1946.—S. L. Seaton, H. W. Wells & L. V. Berkner. **Auroral Research at College, Alaská, 1941-1944.**—S. L. Seaton & C. W. Malich. Combined in Carnegie Institution of Washington Publication 175, 396 pp., $1.85. (*Proc. Inst. Radio Engrs, W. & E.*, May 1948, Vol. 36, No. 5, p. 646.) 335 pages are devoted to hourly values of ionospheric data. 14 pages of tables give zenith auroral intensity measurements. Instruments and instrumental procedures are fully described.

LOCATION AND AIDS TO NAVIGATION

621.396.93 **2796**

Marconi Multi Channel Visual H.F. Direction Finder Type DFG 23.—D. J. Fewings. (*Marconi Rev.*, Jan./March 1948, Vol. 11, No. 88, pp. 1–8.) A single spinning goniometer without range switching provides bearings on four channels for frequencies between 3 and 17.5 Mc/s. The channels are independent both for bearings and for sense and all may work simultaneously, bearings being shown on c.r. tubes with linear scales. Spaced vertical mast aerials of the Marconi Adcock type are used with buried feeders ; no vertical sense aerial is necessary. A signal/noise ratio of 20 db is obtained with signal strengths varying between 0.5 and 6 μV/m. The case containing the goniometer and driving motor is specially designed to reduce noise.

621.396.932 : 534.88(26.03) **2797**

Sofar [sound fixing and ranging].—W. W. Stifler, Jr, & W. F. Saars. (*Electronics*, June 1948, Vol. 21, No. 6, pp. 98–101.) A hyperbolic position-fixing system depending upon the propagation of sound from a small bomb exploded at a critical depth in the ocean. With a combination of three or more receiving stations, the system gives a fix accurate to within 5 miles at a range of 2 000 miles. Continuous-monitoring equipment, used to time the arrival of impulses, is described, with sample records.

621.396.96 **2798**

Principles of Frequency-Modulated Radar.—I. Wolff & D. G. C. Luck. (*RCA Rev.*, March 1948, Vol. 9, No. 1, pp. 50–75.) Principles of operation are discussed in detail and quantitative expressions for the determination of range and speed in terms of the output frequency are derived. The main advantage claimed is that lower peak power is required, the main disadvantages being the slowness of search and the complexity of apparatus required to increase the search speed. To be continued.

MATERIALS AND SUBSIDIARY TECHNIQUES

533.5 : 621.3.032.53 **2799**

The Effect of Various Treatments on the Stresses in Glass-to-Metal Seals.—G. D. Redston & J. E. Stanworth. (*J. sci. Instrum.*, April 1948, Vol. 25, No. 4, pp. 138–140.) The photoelastic method of axial sighting on a bead seal is adapted to the measurement of (*a*) the variation of seal stress with temperature, (*b*) the effect of high temperature and of intensified humidity on seal stress. The seal stress/temperature curve agrees with theory. Most seals are unaffected by humidity ; certain types, notably alkali-borosilicate/tungsten seals, show irregular and striking stress changes after one or more humidity cycles.

533.5 : 621.3.032.53 **2800**

A Titanium Technique for Metal-Ceramic Seals.—H. W. Greenwood. (*Electronic Engng*, March 1948, Vol. 20, No. 241, p. 100.) Extract by H. W. Greenwood from R. I. Bondley's paper noted in 3917 of 1947.

535.37 **2801**

Luminescence Efficiency Changes in Zinc Sulphide Phosphors below Room Temperature.—G. F. J. Garlick & A. F. Gibson. (*Nature, Lond.*, 6th March 1948, Vol. 161, No. 4088, p. 359.) Variation of efficiency at temperatures below that of thermal quenching of luminescence may be either positive or negative, depending on the wavelength of the excitation. Typical curves for a self-activated ZnS phosphor are given and discussed.

535.37 **2802**

The Temperature Dependence of the Fluorescence of Tungstates and Molybdates in Relation to the Perfection of the Lattice.—F. A. Kröger. (*Philips Res. Rep.*, Oct. 1947, Vol. 2, No. 5, pp. 340–348.)

537.228.1 **2803**

EDT and DKT Crystals for Carrier Channel Filters.—W. P. Mason. (*Bell Lab. Rec.*, May 1948, Vol. 26, No. 5, pp. 222–225.) A short account of their principal properties and of the methods of cutting to secure a low temperature-coefficient of frequency. See also 740 of March.

538.221 **2804**

The Adiabatic Temperature Changes accompanying the Magnetization of some Ferromagnetic Alloys in Low and Moderate Fields.—L. F. Bates & E. G. Harrison. (*Proc. phys. Soc.*, 1st March 1948, Vol. 60, No. 339, pp. 213–225.) The temperature changes which occur when a ferromagnetic substance is taken through a single hysteresis cycle have been measured for seven ferromagnetic alloys. A cooling effect is observed initially as the magnetization is reduced from its maximum value. Results indicate that large changes in thermomagnetic properties are caused by small changes in composition. See also 896 of 1941 (Bates & Weston) and 2805 below.

538.221 **2805**

The Adiabatic Temperature Changes accompanying Magnetization in Low and Moderate Fields : A Further Study of Iron.—L. F. Bates & E. G. Harrison. (*Proc. phys. Soc.*, 1st March 1948, Vol. 60, No. 339, pp. 225–235. Discussion, pp. 235–236.) A commercial moving-coil ballistic galvanometer was used with the Bates & Weston method (896 of 1941) of measuring small changes of temperature in the magnetization of iron. Measurements were made on Armco iron, 99.89% pure, and Hilger H.S. electrolytic iron, 99.96% pure. Heat changes associated with the virgin magnetization curve have been measured for the first time. See also 2804 above.

538.221 **2806**

Supermalloy.—(*Bell Lab. Rec.*, March 1948, Vol. 26, No. 3, pp. 111–113.) A brief general discussion. See also 2802 of 1947 (Boothby & Bozorth).

538.221 : 621.317.41 **2807**

The Measurement of the Permeability of Low-Conductivity Ferromagnetic Materials at Centimetre Wavelengths.—J. B. Birks. (*Proc. phys. Soc.*, 1st March 1948, Vol. 60, No. 339, pp. 282–292.) The complex magnetic and dielectric properties of a specimen filling a section of waveguide are derived from standing-wave measurements of the short-circuit and open-circuit impedances of the section. Measurements were made for λ 60–1$\frac{1}{4}$ cm ; typical results for γ ferric oxide are given. Magnetic dispersion is apparently an inherent property of the material and is not attributable to skin effect.

538.27 **2808**

The Effect of an Airgap on the Complex Permeability of Coil Cores.—R. Feldtkeller & E. Stegmaier. (*Frequenz*, March 1948, Vol. 2, No. 3, pp. 71–79.) Experimental results for various core materials show how the curves connecting the complex permeability with the amplitude of the a.c. induction and with the frequency are displaced when an airgap is used. The curves relating the Q of a coil to frequency are displaced towards higher frequencies, in a direction parallel to the frequency axis; the amount of the shift depends on the effective width of the airgap used.

546.23 : 537.311.33 **2809**

On the Electrical Conductivity of Selenium Crystals.—F. de Boer. (*Philips Res. Rep.*, Oct. 1947, Vol. 2, No. 5, pp. 352–356.) Values ranging from 2×10^4 to 5×10^4 Ω cm were obtained for the specific resistance of Se monocrystals parallel to the c-axis; it is suggested that the value for a pure monocrystal lies near the lower limit. The specific resistance at right angles to the c-axis was found to be 2×10^6 Ω cm. Experimental results concerning the effect of temperature and pressure on the conductivity are also discussed.

546.431.82 : 548.5 **2810**

The Growth of Barium Titanate Crystals.—B. Matthias. (*Phys. Rev.*, 1st April 1948, Vol. 73, No. 7, pp. 808–809.) Quantitative data for an advanced growing technique. See also 2535 of September (Walker).

548.0 : 53 **2811**

Physical Properties of Crystals and Their Symmetry.—M. Tournier. (*Elect. Commun.*, Dec. 1947, Vol. 24, No. 4, pp. 478–525.) The particular symmetry conditions of various crystalline substances indicate certain phenomena that are likely to take place in the material. A short review of the historical background of piezoelectricity is followed by an introduction to linear transformation theory, tensor algebra and matrix algebra. Proofs of theorems of symmetry are obtained by matrix multiplication. Symmetry in crystals is defined, and shown to determine whether the moduli relating physical effects to their causes are finite or zero. Pyroelectricity, dielectric susceptance, piezoelectricity, elasticity and piezomagnetism are examined in this way. The 32 classes of symmetry in crystals are described and illustrated, and the components of the characteristic tensors are tabulated for each class.

549.514.51 : 621.396.611.21 **2812**

Quartz Crystals.—E. A. Fielding. (*Proc. R.S.G.B.*, 1948, No. 3, pp. 1–7.) Long summary of R.S.G.B. paper. A general discussion of the production of quartz crystal plates, their defects and piezoelectric properties, and of the use of such crystals in resonant circuits and filters.

549.514.51(73) **2813**

Domestic Sources of Piezoelectric Quartz.—H. H. Waesche. (*Amer. J. Sci.*, March 1948, Vol. 246, No. 3, pp. 182–185.) Discussion of possible American sources of supply other than Brazil.

549.623.5 **2814**

Mica: its Preparation and some Applications.—A. E. Williams. (*Engineer, Lond.*, 5th March 1948, Vol. 185, No. 4806, pp. 227–229.) An account of the different varieties of mica, their chemical composition, physical properties, and place of origin, with details of the manufacture and properties of micanite.

620.193 + 620.197 **2815**

Tropical Proofing of Radio Apparatus for Use in Tropical Climates.—(*Radio Component Mfrs' Fed. tech. Bull.*, Feb. 1948, Vol. 1, No. 6, pp. 3–5.) In the tropics destructive insects abound, and temperatures of 85–90°F with relative humidity 100% are common. The effect on radio and other equipment is discussed. Protective measures are suggested. High-quality components must be used, as radio service hardly exists. See also 2816 below.

621.3(54) : [620.193 + 620.197 **2816**

Electrical Engineering Problems in the Tropics.—R. Allan. (*J. Instn elect. Engrs*, Part II, June 1948, Vol. 95, No. 45, pp. 275–283; summary, *ibid.*, Part I, June 1948, Vol. 95, No. 90, p. 274. Discussion, pp. 283–289.) Full paper; summarized in 1378 of May and 1658 of June.

621.3.013.783† : 621.316.97 **2817**

Screening at V.H.F.—B. Rosen. (*Wireless Engr*, July 1948, Vol. 25, No. 298, pp. 221–230.) An experimental method of testing the effectiveness of various sprayed and deposited metal surfaces. The change in width of a resonance curve is observed when the screen is introduced; the surface resistivity is deduced. Results are given for Cu and Zn sprayed on a plastic base and for Cu and Ni electro-deposited on a steel base.

621.3.015.5.029.63/.64 : 546.217 **2818**

The Microwave Spark.—D. Q. Posin. (*Phys. Rev.*, 1st March 1948, Vol. 73, No. 5, pp. 496–509.) The breakdown of an airgap was studied experimentally for λ 1.25, 3 and 10 cm. The required field is strongly dependent on the width of the pulse, the intensity of initial ionization (as determined by nearby radioactive materials), gap width and pressure, and to a less degree on pulse repetition rate. See also 750 of March (Cooper).

621.315.61 **2819**

Recent Researches on Insulating Materials.—L. Piaux: G. Beauvais. (*Tech. mod.*, 1st/15th March 1948, Vol. 40, Nos. 5/6, pp. 85–88. In French.) A review, partly from the chemical and partly from the electrical standpoint, of present knowledge of polymer plastics and of ceramics of the titanate groups.

621.315.61 : 546.287 **2820**

Silicone Rubbers and their Use as Insulators in Electrotechnics.—M. de Buccar. (*Rev. gén. Élect.*, March 1948, Vol. 57, No. 3, pp. 93–102.) A short discussion of their chemical structure and a detailed account of their physical and electrical properties. The wide range of temperature over which the mechanical and electrical characteristics are maintained renders these rubbers particularly useful for extreme operating conditions. Resilience and flexibility are maintained down to about −60°C and cables insulated with silastic have shown no signs of damage after heating to 250°C. Numerous practical applications are mentioned.

621.315.61.011.5 **2821**

Dielectric Losses.—J. Granier. (*C. R. Acad. Sci., Paris*, 26th April 1948, Vol. 226, No. 17, pp. 1354–1356.) A modification of Debye's theory leads to a formula representing the 'goodness' of a dielectric, which gives results in good agreement with measured values for glycerine and for a phenolic resin.

621.315.616 : 621.785.545.45 **2822**

The Hardening of Synthetic Materials in High-Frequency Fields.—H. Stäger. (*Brown Boveri Rev.*, June/July 1947, Vol. 34, Nos. 6/7, pp. 129–138.) Results of a comprehensive series of tests on laminated materials and wood/wood bonds. Optimum working conditions are established by which setting time is greatly reduced and maximum strength attained. Synthetic resins with a nitrogen constituent give a wood bond immune to tropical conditions and bacterial attack.

621.315.616 : 666.18 : 679.86 **2823**

Scale Glass as a Substitute for Mica.—J. M. Stevels. (*Philips Res. Rep.*, Jan. 1946, Vol. 1, No. 2, pp. 129–134.) A product composed of small scales, preferably of thickness 1–5 μ, which adhere under certain conditions and are formed into plates in distilled water to which is added a little H_3PO_4 and K_2SiO_3. The plates when partly dried are deformable. Various applications are suggested.

621.315.618 **2824**

New Researches on the Dielectric Strength of Compressed Gases.—N. J. Félici & Y. Marchal. (*Rev. gén. Élect.*, April 1948, Vol. 57, No. 4, pp. 155–162.) The breakdown properties of gases at ordinary pressure are discussed with particular reference to Townsend's theory. Possible causes of discrepancies with Paschen's law are examined. The apparatus and method used for investigations at potentials up to 250 kV and pressures up to 70 atmospheres are described. Results are tabulated for air and for H_2, with electrodes of different materials. While stainless steel electrodes only give a breakdown strength, in vacuo, of 20 kV/mm, in compressed gases they give values 5 or 6 times greater.

621.316.99 **2825**

Earthing Problems.—R. W. Ryder. (*J. Instn elect. Engrs*, Part II, April 1948, Vol. 95, No. 44, pp. 175–184; summary, *ibid.*, Part I, May 1948, Vol. 95, No. 89, p. 226.) Discussion of the various factors which affect the resistance of earth electrodes, with a review of earthing practice.

621.318.22 : 621.775.7 **2826**

Permanent Magnets.—S. J. Garvin. (*Elect. Times*, 27th May 1948, Vol. 113, No. 2951, pp. 633–636.) Discussion of the properties of various materials, with special reference to the advantages and limitations of the sintering process.

621.791.3 : 669.715 **2827**

Soldering Aluminium Alloys.—F. W. Thomas & E. Simon. (*Electronics*, June 1948, Vol. 21, No. 6, pp. 90–92.) The soldering-iron tip is vibrated at an ultrasonic frequency by means of a magnetostriction valve-driven oscillator. Surface oxidation is thus removed. The method can be applied to other surfaces which are difficult to solder normally.

666 + 669] : 621.775.7 **2828**

Metal Ceramics.—H. H. Hausner. (*Metal Ind., Lond.*, 14th May 1948, Vol. 72, No. 20, pp. 405–407.) A description of the properties of 'ceramals', materials formed from ceramic and metal powders. Two groups are considered: (*a*) mixtures of metallic and ceramic powders, and (*b*) combinations using different layers of metal powders and ceramic powders. The metal powders in the first group act as producers of free electrons or reducing agents for the ceramic oxides. Different combinations give a wide range of temperature coefficients. The second group includes materials resistant to high temperatures and suitable for use in jet engines and for turbine blades.

666.1 **2829**

The Physical Properties of Glass in relation to its Structure.—J. M. Stevels. (*J. Soc. Glass Technol.*, 1946, Vol. 30, pp. 31–53; summary in *Philips Res. Rep.*, Oct. 1947, Vol. 2, No. 5, p. 400.) A discussion of present knowledge of the structure of glass in relation to its density and electrical conductivity.

669.74/.75 : 621.3.011.2 **2830**

Study of the Variation of Electrical Resistance with Temperature of MnSb Ferromagnetic Alloy.—G. Mannevy-Tassy. (*C. R. Acad. Sci., Paris*, 19th May 1948, Vol. 226, No. 20, pp. 1592–1593.) Curves are given showing the resistance variation between −200°C and +650°C. The changes are cyclic up to about 450°C, but if this temperature is exceeded, the resistance for decreasing temperatures is considerably less than for increasing temperatures.

678 : [620.193 + 620.197 **2831**

Rubber and the Weather.—J. Crabtree. (*Bell Lab. Rec.*, March 1948, Vol. 26, No. 3, pp. 119–123.) A general discussion of the various kinds of damage that can be caused by exposure, and of methods of producing such damage artificially and of preventing it in practice.

MATHEMATICS

513.3 : 621.392.029.64 **2832**

Geometry of Rectangular Waveguides.—Bartlett. (*See* 2722.)

517.512.2 : 621.396.67 **2833**

The Fourier Transform of the Incomplete Gaussian Function.—G. Millington. (*Marconi Rev.*, Jan./March 1948, Vol. 11, No. 88, pp. 17–30.) The function $G\left(\frac{z}{\pi a}\right) = \frac{2}{\alpha}\int_0^k \exp(-y^n)\cos(zy/k)dy$ is considered by studying an allied contour integral. The method of steepest descents is used to obtain asymptotic forms for large values of the argument; a Maclaurin expansion is used for small values. $G(z/\pi a)$ has 'side lobes' even for an infinite aperture when $n > 2$. The important case when $n = 2$ is discussed by an alternative method involving approximate numerical integration of a differential equation; 'side lobe' amplitudes are given as functions of the width of the finite aperture.

518.5 : [512.25 + 512.831 **2834**

An Automatic Simultaneous Equation Computer and its Use in Solving Secular [i.e. characteristic] **Equations.**—W. A. Adcock. (*Rev. sci. Instrum.*, March 1948, Vol. 19, No. 3, pp. 181–187.) Discussion of the design of an analogue computer based on a feedback method which is more general than the Gauss-Siedel iteration method discussed on p. 85 of Murray's book [noted in 1074 of April]. Resistive voltage dividers represent the coefficients, and voltages represent the variables, which are automatically adjusted by the feedback system. Accuracy within 1% can be expected. The operation is explained in detail for sets of four equations. Problems where the characteristic equation has repeated roots can be solved. [*Note.* No indication is given of the maximum number of equations and variables for which the method will work.]

518.61 **2835**

The Approximate Solution of Linear Differential Equations.—M. C. Gray & S. A. Schelkunoff. (*Bell Syst. tech. J.*, April 1948, Vol. 27, No. 2, pp. 350–364.) Examples of the application of a wave perturbation method, illustrating its high accuracy in solving certain equations used in electromagnetic and other problems. See also 1570 of 1946.

519.2 : 621.385.1 **2836**

Notes on the Exponential Distribution in Statistics [of valve life].—N. W. Lewis. (*P.O. elect. Engrs' J.*, April 1948, Vol. 41, Part 1, pp. 10–12.) An elementary account, indicating the relation between the exponential and Poisson distributions.

MEASUREMENTS AND TEST GEAR

53.08 + 621.3.08 **2837**

Précis of a Discussion on 'Practical Considerations in Instrument Design' — London, 1948.—(*J. sci. Instrum.*, April 1948, Vol. 25, No. 4, pp. 122–124.) Suggestions made included:—(*a*) Scales should be easy to read. (*b*) Difficulties connected with wear and lubrication may be lessened by substituting rolling spheres or cylinders for sliding constraints. (*c*) Precision measuring instruments of the future should use inertialess beams of light or cathode rays. The relative merits of kinematic and electrical instruments were discussed and improvements in design detail were suggested. Another account in *Engineer, Lond.*, 12th March 1948, Vol. 185, No. 4807, p. 257.

531.76 : 681.11 **2838**

Measuring the Rate of Watches with a Cathode-Ray Oscillograph.—H. van Suchtelen. (*Philips tech. Rev.*, 1947/1948, Vol. 9, No. 10, pp. 317–320.) By means of a microphone and amplifiers, watch ticks are converted to voltage peaks producing a vertical deflection on a c.r.o. The timebase voltage is synchronized with a standard frequency of 60 c/s derived from a quartz oscillator by frequency division. The speed at which the voltage peaks move across the c.r.o. screen thus gives a measure of the rate error of the watch. Rate errors of a few seconds per day can be determined in a few minutes. See also 1669 of June (Mackay & Soule).

621.317.029.63 **2839**

Improvements in Decimetre-Wave Measurement Technique.—H. H. Meinke. (*Frequenz*, Feb. 1948, Vol. 2, No. 2, pp. 41–49.) General account of modern methods using concentric transmission lines.

621.317.32 : 551.508.94 **2840**

A Radiosonde Method for Atmospheric Potential Gradient Measurements.—R. E. Belin. (*Proc. phys. Soc.*, 1st April 1948, Vol. 60, No. 340, pp. 381–387.) For another account see 1674 of June.

621.317.333 + 621.317.37] : 621.315.212.029.6 **2841**

The Voltage Characteristics of Polythene Cables.—R. Davis, A. E. W. Austen & W. Jackson. (*J. Instn elect. Engrs*, Part III, March 1948, Vol. 95, No. 34, pp. 111–112.) Discussion on 3179 of 1947.

621.317.333.4 : 621.315.212 **2842**

Pulse Techniques in Coaxial Cable Testing.—F. F. Roberts. (*P.O. elect. Engrs' J.*, April 1948, Vol. 41, Part 1, pp. 13–17.) The principles of fault location by pulse technique are discussed. Intermittent faults can be found by display of echoes of 3-μs d.c. pulses on a c.r.o. Equipment has been developed for measuring small impedance irregularities under conditions similar to those in long-distance television relay systems. This equipment gives 0.3-μs pulses of a 20-Mc/s carrier, with a spacing of about 500 μs.

621.317.336 **2843**

A Note on the Lecher Wire Method of Measuring Impedance.—M. Williamson. (*Proc. phys. Soc.*, 1st April 1948, Vol. 60, No. 340, pp. 388–391.) Discussion of factors which affect the accuracy of measurements by Williams' method (1255 of 1944).

621.317.374 **2844**

On the Determination of the Loss Angle of a Dielectric inserted in a Double Line.—P. Abadie. (*C. R. Acad. Sci., Paris*, 19th May 1948, Vol. 226, No. 20, pp. 1590–1592.) Formulae are derived which can be used for frequencies as high as 3 000 Mc/s.

621.317.41 : 538.221 **2845**

The Measurement of the Permeability of Low-Conductivity Ferromagnetic Materials at Centimetre Wavelengths.—Birks. (*See* 2807.)

621.317.715.5 **2846**

Anti-Vibration Immersion Galvanometer.—M. Picard. (*Rev. gén. Élect.*, April 1948, Vol. 57, No. 4, pp. 141–146.) The mean density of the moving system is the same as that of the C_2Cl_4 in which it is immersed, and its centre of gravity coincides with the geometric centre, so that the instrument is insensitive to all translation acceleration. Sensitivity is not very high, but the robust construction and freedom from shock effects makes the galvanometer particularly useful under conditions which would put other instruments out of action.

621.317.725/.726 **2847**

Stable Voltmeter Amplifier.—J. D. Clare. (*Wireless Engr*, July 1948, Vol. 25, No. 298, pp. 231–236.) Analysis of a d.c. amplifier circuit which can be used either as an e.s. d.c. voltmeter or, with a diode probe, as an a.c. peak voltmeter. Changes in supply voltage and valve parameters have practically no effect on the meter reading.

621.317.725 **2848**

Inverted Valve Voltmeter.—W. Geyger. (*Arch. tech. Messen*, June 1948, No. 155, T78–79, 4 pp.) Discussion of the principles and performance of voltmeters in which the voltage to be measured is applied between anode and cathode of a triode valve. For a.c. voltages, the use of a small voltage transformer with a centre-tapped secondary, whose two sections are connected to the anodes of a double triode and to the common cathode, gives greater sensitivity. See also 3974 of 1945 (Foster).

621.317.725.027.7 **2849**

The Design of an Ellipsoid Voltmeter for the Precision Measurement of High Alternating Voltages.—F. M. Bruce. (*J. Instn elect. Engrs*, Part II, June 1948, Vol. 95, No. 45, pp. 364–365.) Discussion on 3584 of 1947.

621.317.728.029.6 **2850**

Calibration of Uniform-Field Spark-Gaps for High-Voltage Measurement at Power Frequencies.—F. M. Bruce. (*J. Instn elect. Engrs*, Part II, June 1948, Vol. 95, No. 45, pp. 364–365.) Discussion on 3585 of 1947.

621.317.73 **2851**

Direct-Reading Impedance Meter.—J. Schifrine. (*Rev. tech. Comp. franç. Thomson-Houston*, April 1948, No. 10, pp. 31–40. In French, with English summary.) Theory and circuit details of instruments which give both the real and imaginary components of an impedance. Accuracy is within about 3%. One instrument can measure impedances up to several hundred ohms at frequencies in the range 0–10 000 c/s, with impedance currents up to 0.5 A. The second can be used for impedances up to 1 MΩ, has a frequency range of 30–10 000 c/s, and is independent of the power in the impedance.

621.317.73 : 621.317.755 **2852**

Frequency-Scanning V.H.F. Impedance Meter.—L. L. Libby. (*Electronics*, June 1948, Vol. 21, No. 6, pp. 94–97.) An instrument designed to display at any instant the impedance/frequency curve; it can scan rapidly bandwidths up to 30 Mc/s in the range 10–250 Mc/s. The output, which can be used with any c.r.o., is proportional to the amount of energy reflected from the end of a transmission delay-line to which the apparatus under test is connected. Details of design are given and the method of operation is described, with an example.

621.317.733 **2853**

Theory of Wagner Ground Balance for Alternating-Current Bridges.—R. K. Cook. (*Bur. Stand. J. Res.*, March 1948, Vol. 40, No. 3, pp. 245–249.) A method is described for using a Wagner earth with any 3-terminal source for elimination of earth capacitance effects. The basic idea is the insertion of impedances between the two ungrounded terminals of the source and the corresponding terminals of the Wagner earth and the bridge, so as to balance approximately the currents from the source. The method is applicable to h.v. Schering bridges. A Schering bridge incorporating the principles of the new method is described ; this is designed primarily for the measurement of the small capacitances, about 50 pF, of some types of capacitor microphone.

621.317.733 : 621.396.677 **2854**

Transmission-Line Bridge.—C. H. Westcott. (*Wireless Engr*, July 1948, Vol. 25, No. 298, pp. 215–220.) Four $\lambda/4$ sections of transmission line are connected in a re-entrant loop, one section containing a transposition of the two feeder wires. Equal loads connected to opposite corners of the loop may be fed simultaneously by two generators connected to the two remaining corners. No interaction occurs between the generators, but by altering their relative phase the total power can be applied to each load in turn. When this principle is applied to a receiving array, using two receivers as the loads, one receiver may be made to respond to off-target bearings only, and its output used to cancel (at video frequency) the output of the main receiver, resulting in an apparent lobe narrowing. Another application is the production of split beams with a common aerial. The system may be used over a fairly wide frequency range, as its action depends only on symmetry. See also 1355 of 1947 (Taylor & Westcott).

621.317.755 : 621.396.813 **2855**

Technique for Distortion Analysis.—S. Sabaroff. (*Electronics*, June 1948, Vol. 21, No. 6, pp. 114–117.) The effect of the circuits under observation on clipped sine waves is displayed on a c.r.o. Typical patterns are reproduced, and simple equipment comprising biased crystal rectifiers is described.

621.317.761 **2856**

Checking F.M. Transmitter Frequencies with WWV.—R. R. Freeland. (*Communications*, May 1948, Vol. 28, No. 5, pp. 16–18, 31.) The equipment includes a specially designed secondary standard consisting of a 6F6 oscillator driving a 10-kc/s multivibrator, which in turn drives a 2-kc/s multivibrator. Two stages of amplification provide harmonic outputs up to 110 Mc/s. The transmitter frequency and a standard WWV frequency are both compared with this secondary standard.

621.317.79 : 621.394.813 **2857**

The Measurement of Telegraph Distortion.—A. B. Shone & R. T. Fatehchand. (*Electronic Engng*, June 1948, Vol. 20, No. 244, pp. 181–185.) The main features of the B.B.C. 'start-stop' distortion measurement set are the phantastron timebase and the 'Multiar'. The 'start' pulse triggers the timebase ; the sweep duration is 125 ms, so that the entire teleprinter signal between successive start pulses can be displayed on a c.r.o. The phantastron output also feeds the Multiar. By adjustment of a calibrated auxiliary voltage, the Multiar will fire at any point on the timebase to produce a bright spot. The auxiliary voltage is regulated by a potentiometer network calibrated from 0–130 ms. Distortion can be measured to an accuracy within 2½%.

Details of the phantastron and Multiar circuits, given fully in 985 of April (Williams & Moody), are summarized in an appendix. See also 2478 of September (Close & Lebenbaum).

621.317.79 : 621.396.615.12 : 621.395.813 **2858**

An Improved Intermodulation Measuring System.—G. W. Read & R. R. Scoville. (*J. Soc. Mot. Pict. Engrs*, Feb. 1948, Vol. 50, No. 2, pp. 162–173.) Description of an intermodulation analyser and associated two-signal generator, for measuring distortion in a.f. systems. Paired signals are used ; they can be selected in several combinations from 40 to 12 000 c/s. The equipment is particularly useful for determining optimum processing conditions for variable-density recording.

621.317.79 : 621.396.813 **2859**

The Measurement of Delay Distortion in Microwave Repeaters.—D. H. Ring. (*Bell Syst. tech. J.*, April 1948, Vol. 27, No. 2, pp. 247–264.) I.R.E. 1947 National Convention paper. Description of equipment which can measure delay distortion of the order of 10^{-9} sec in a wide-band television relay repeater. Circuits are discussed (*a*) for measuring relative phase shift as a function of frequency, from which the delay distortion is computed, (*b*) for direct delay measurement. The equipment is designed for an i.f. between 50 and 80 Mc/s but can be adapted for use at microwave frequencies.

621.317.79 : 621.396.822 **2860**

Method of Measurement of Noise Ratios and Noise Factors.—A. van der Ziel. (*Philips Res. Rep.*, Oct. 1947, Vol. 2, No. 5, pp. 321–330.) Crystals, valve circuits and receivers are tested by this method. A saturated diode provides a noise output for use as a test signal, its output level being monitored by a linear amplifier (bandwidth 50–100 kc/s) and a thermocouple.

621.317.79 : 621.396.97 **2861**

Monitor for Frequency-Modulation Broadcasting.—M. Silver. (*Elect. Commun.*, Dec. 1947, Vol. 24, No. 4, pp. 428–432.) A detailed description of a monitor designed to meet F.C.C. specifications. Using separate discriminators, the centre transmission frequency is measured with an error of ± 100 c/s under full modulation conditions, and modulation percentage is measured within ± 5%. Noise and distortion monitoring facilities and an overmodulation warning are provided. The inherent noise and distortion in the monitor are estimated.

621.317.794.029.64 **2862**

The D.C. Thermal Characteristics of Microwave Bolometers.—E. Peskin & E. Weber. (*Rev. sci. Instrum.*, March 1948, Vol. 19, No. 3, pp. 188–195.) A theoretical study of the temperature distribution and variation of resistance of a temperature-sensitive, resistive rod. Both linear and quadratic thermal laws are postulated, and the results are compared with experimental curves for actual bolometers. The sensitivity of resistance to changes in the direct current is defined and computed.

621.319.4.089.6 **2863**

The Calibration of Capacitors at the National Physical Laboratory, 1947.—G. H. Rayner & L. H. Ford. (*J. Instn elect. Engrs*, Part II, June 1948, Vol. 95, No. 45, pp. 312–318 ; summary, *ibid.*, Part I, May 1948, Vol. 95, No. 89, p. 234.) Astbury's modification of the Carey-Foster bridge is briefly described and a more detailed account is given of the precision Schering bridge used, in which particular attention is paid to screening. Possible errors are within 1 part in 10^4 for capacitance and 0.002% for power factor when measuring any but the smallest capacitances.

621.396.69.001.4 **2864**

Tests for the Selection of Components for Broadcast Receivers.—G. D. Reynolds. (*J. Instn elect. Engrs*, Part III, March 1948, Vol. 95, No. 34, pp. 54–64. Discussion, pp. 64–68.) Methods are described for finding out whether a given component is suitable for incorporation in a range of radio or television receivers ; the results of such tests are surveyed. Fuller details are given for the less usual methods.

621.317.7.029.64 **2865**

Techniques of Microwave Measurements. [Book Review]—C. G. Montgomery (Ed.). McGraw-Hill, New York, 1947, 922 pp., $10. (*Proc. Inst. Radio Engrs, W. & E.*, May 1948, Vol. 36, No. 5, p. 645.) Volume 2 of the Radiation Laboratory series. Laboratory types of measuring equipment are described. " Fourteen authors, each an expert in one or more fields, have contributed to write a complete story. Although complete, it does not pretend to be exhaustive. There are numerous references . . ."

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

533.15 : 537.534 **2866**

Vapour Leak Detection by Thermionic Effects.—W. C. White & H. S. Hickey. (*Electronic Industr.*, March 1948, Vol. 2, No. 3, pp. 7–8.) Another account noted in 2303 of August.

534.321.9.001.8 : 57 **2867**

Applications of Ultrasonics to Biology.—S. Y. White. (*Audio Engng, N.Y.*, June 1948, Vol. 32, No. 6, pp. 30 . . 45.) Discussion of applications to the sterilizing of liquids and also in medical research.

535.61-14/-15 **2868**

Infra-Red Instrumentation and Techniques.—V. Z. Williams. (*Rev. sci. Instrum.*, March 1948, Vol. 19, No. 3, pp. 135–178.) An extensive summary of instruments and experimental methods used for λ between 2.5 μ and 1 cm. Molecular absorption in the near infra-red (2.5–25 μ) is discussed, and industrial application of spectrometry in this region described, with details of the sources, dispersive media, optical systems, absorption cells and detectors used. Photosensitive detectors and grating spectrometers used in the far infra-red (up to 350 μ) are briefly described. Some experiments on gaseous absorption in the microwave region are mentioned, in which bolometers, crystals, or radiometers are used as detectors. Infra-red filters are described, together with various applications of infrared radiation in pyrometry and military equipment. A bibliography of 210 items is included.

536.53 **2869**

Electronic Instruments in Temperature Measurement.—I. P. Buchanan. (*Aust. J. Instrum. Tech.*, March 1947, Vol. 3, No. 2, pp. 88–106.) Only instruments whose actuating elements are thermocouples or resistance thermometers are considered. Two main classes are: (*a*) those for which a galvanometer is the detecting device, but the movement of the pointer is not impeded, (*b*) the ' null ' balance type, which has no galvanometer. Several commercial instruments in both classes are described. Valves used in such instruments should be operated well below their ratings for radio receiver design ; a reserve of power is usually available so that aging seldom causes failure.

539.16.08 **2870**

Modern Geiger-Müller Tubes.—O. J. Russell. (*Electronic Engng*, March 1948, Vol. 20, No. 241, pp. 70–73.) A brief discussion of their modes of operation, typical performance figures, and their use for estimating natural potassium, which contains an isotope emitting β rays.

621.317.792 **2871**

A Lightning Warning Device.—Schonland & Gane. (*See* 2793 and 2794.)

621.365.5 **2872**

Melting Metals by Induction Heating.—N. R. Stansel. (*Gen. elect. Rev.*, March 1948, Vol. 51, No. 3, pp. 35–42.) Operation data, electrical features, construction and applications of coreless-induction and submerged-resistor types of heating equipment.

621.384.6 **2873**

On the Dynamics of Electrons in a Linear Accelerator.—A. Messiah. (*C. R. Acad. Sci., Paris*, 26th April 1948, Vol. 226, No. 17, pp. 1357–1359.) Discussion of the effect of fluctuations of the electron velocity, in the neighbourhood of the velocity of light, on the output energy spectrum.

621.384.6 **2874**

A High Frequency Cyclotron Generator with Demountable Tubes.—H. Atterling & G. Lindström. (*Ark. Mat. Astr. Fys.*, 16th April 1948, Vol. 35, Part 1, Section A, No. 4, 9 pp. In English.) Description of the h.f. oscillator now in use for the 32-inch cyclotron at the Nobel Institute for Physics in Stockholm.

621.384.6 **2875**

An Equipment for Automatic [cyclotron] **Resonance Control.**—G. Lindström. (*Ark. Mat. Astr. Fys.*, 16th April 1948, Vol. 35, Part 1, Section A, No. 5, 8 pp. In English.) For cyclotron resonance, the product of the magnetic field and the wavelength of the h.f. system is constant. Both these quantities, however, are liable to drift slowly and steadily. By charging two capacitors in successive equal intervals, and then coupling the capacitors in series, a difference voltage dependent on the rate of drift is obtained. This voltage is used to correct for the drift by altering the magnet current.

621.384.6 : 621.386 **2876**

Recent Progress in the Production of X Rays.—J. Saget. (*Bull. Soc. franç. Élect.*, May 1948, Vol. 8, No. 81, pp. 245–254.) Modern developments of h.v. equipment, including Van de Graaff generators and all types of particle accelerators, whose principles of operation are described and characteristics tabulated.

621.385.833 **2877**

The Focal Length of a Long Magnetic Lens.—N. Svartholm. (*Ark. Mat. Astr. Fys.*, 16th April 1948, Vol. 35, Part 1, Section A, No. 6, 9 pp. In English.) A formula is obtained for the focal length under stated assumptions. Two types of definite integral are involved. See also 2205 of 1941 (Glaser).

621.385.833 **2878**

100-kV Electron Microscope.—(*Elect. Times*, 15th April 1948, Vol. 113, No. 2945, p. 463.) A new Metropolitan-Vickers model, E.M.3, which differs from Type E.M.2 principally in the redesign of the electron gun and in the introduction of an extra intermediate projection lens. This lens allows the magnification to be varied continuously from 1 000 to 100 000, without alteration of the focal length of the object lens, and also enables the overall length of the instrument to be reduced considerably.

621.385.833 **2879**

Experimental Electron Microscope.—(*Engineer, Lond.*, 28th May 1948, Vol. 185, No. 4818, p. 517.) An illustrated description of the Plessey Co.'s instrument. Suitable specimens can be directly viewed at magnifications up to 20 000 diameters and the images can be further enlarged 10 times by optical methods.

621.385.833 **2880**

On the Shape of the Field for Electrostatic Lenses.—V. V. Sorokina & P. V. Timofeev. (*Zh. tekh. Fiz.*, April 1948, Vol. 18, No. 4, pp. 509–516. In Russian.)

621.395.658 **2881**

A Magnetic Stepping Switch for Control Applications.—A. F. Horlacher. (*Electronic Industr.*, March 1948, Vol. 2, No. 3, pp. 3–5, 11.) Discussion of a switch, essentially similar to those used in automatic telephones, for (*a*) selection of one channel out of 20 or 40, (*b*) sequence control, (*c*) counting, (*d*) cumulative addition, (*e*) production of a coded series of pulses.

621.396.9 : 623.26 **2882**

Buried Metal Detection.—(*Elect. Times*, 11th March 1948, Vol. 113, No. 2940, p. 307. Discussion, p. 308.) Summary of two I.E.E. papers. The first, " Development and Use of Magnetic Apparatus for Bomb and Mine Detection ", by A. Butterworth, shows the superiority of magnetic over induction detectors for location at great depths. The second, " Development of Locators for Small Metallic Bodies Buried in the Ground ", by Roston, discusses the history and future design trends of a.f. detectors, which can be used to discriminate against low-conductivity magnetic materials.

629.13.05 **2883**

The Physical Principles of Some Basic Aircraft Instruments.—W. H. Hoather. (*J. sci. Instrum.*, April 1948, Vol. 25, No. 4, pp. 113–122.) General theory and design of altimeter, air speed indicator, Machmeter, climb indicator, magnetic compass and similar instruments. Particulars of performance and accuracy are included.

PROPAGATION OF WAVES

621.396.11 : 551.510.535 **2884**

Ionospheric Refraction.—S. Estrabaud. (*Onde élect.*, April 1948, Vol. 28, No. 253, pp. 146–149.) A rigorous law of refraction is established, and the approximations of Försterling and Lassen are critically discussed. Comparison between results deduced from an approximate formula and from that of Försterling and Lassen shows their approximation to be satisfactory in practice. In consequence, the English abacs are to be trusted in all cases where the ion distribution is truly parabolic.

621.396.11 : 551.510.535 **2885**

Ionospheric Disturbances.—G. H. M. Gleadle. (*P.O. elect. Engrs' J.*, April 1948, Vol. 41, Part 1, pp. 34–38.) Discussion of the two main kinds of disturbance that upset long-distance s.w. radio communication and of methods of counteracting them, with special reference to the great solar flare of July, 1946.

621.396.11 : 551.510.535 **2886**

Techniques for the Application of Ionosphere Data to Practical Short Wave Transmission and Reception.—T. W. Bennington. (*Proc. R.S.G.B.*, 1948, No. 2, pp. 1–7.) A review of the present knowledge of the ionosphere with particular reference to its effect on long distance s.w. propagation. Typical curves of diurnal, seasonal and solar cycle variations of the critical frequency are given, and methods of m.u.f. forecasting are outlined.

621.396.11 : 551.510.535 **2887**

The Determination of Maximum Usable Frequencies for Radio Links.—P. Lejay. (*Onde élect.*, April 1948, Vol. 28, No. 253, pp. 129–146.) A detailed account, with critical comparison, of American and British methods for the case of (*a*) a plane earth, and (*b*) a curved earth. Modification of the results when account is taken of the effect of the earth's magnetic field is also considered.

621.396.11 : 551.594.6 **2888**

A Possible Mode of Propagation of the ' Slow ' or Tail Component in Atmospherics.—A. L. Hales. (*Proc. roy. Soc. A*, 22nd April 1948, Vol. 193, No. 1032, pp. 60–71.) Surface wave solutions for the propagation of e.m. waves between infinite plane conductors are obtained. If one of the layers is of finite conductivity, there is a solution which corresponds qualitatively with the observed velocities and periods of the slow component.

621.396.11.029.58 **2889**

Short-Wave Echoes.—H. A. Hess. (*Funk u. Ton*, May 1948, Vol. 2, No. 5, pp. 244–253.) Describes investigations of the reception of signals from stations less than 1 000 km distant, where multipath effects and scattering are often observed. The bearing of such effects on the measurement of the time taken for a signal to travel round the earth, and on the measurement of the distance of a transmitter, are discussed. Measurements on signals that have travelled several times round the earth, and on split signals, are also described. See also 2053 of July.

621.396.81 **2890**

Some Effects of Obstacles on the Propagation of Very Short Radio Waves.—E. C. S. Megaw. (*J. Instn elect. Engrs*, Part III, March 1948, Vol. 95, No. 34, pp. 97–105.) Diffraction at a straight edge and round a cylinder is considered, and the scattering of e.m. waves from cylinders is discussed theoretically. Experimental results show the effects of ships' masts and superstructures on v.h.f. communication and navigational radar. In most of the practical problems discussed, prediction to a useful degree of approximation is found possible. Results are also given for transmission over land, showing the effects on decimetre and centimetre waves of hills, trees, buildings, etc., near to or directly in the path of the beam. See also 509, 511 and 518 of 1947.

621.396.81 : 518.3 **2891**

Free Space Microwave Propagation.—A. L. Hammerschmidt. (*RCA Rev.*, March 1948, Vol. 9, No. 1, pp. 159–166.) Abacs for calculating the performance of microwave relay equipment.

621.396.812 **2892**

Simultaneous Field Strength Recording on 47.1, 106.5 and 700 Megacycles.—W. L. Carlson. (*RCA Rev.*, March 1948, Vol. 9, No. 1, pp. 76–84.) For the lower frequencies the 45-mile path was just beyond optical range, but the 700-Mc/s transmitting aerial was 340 ft higher than the others ; the receiving aerials were located together. Transmissions were recorded on all three frequencies during the summer of 1946 and intermittently thereafter on 47.1 and 106.5 Mc/s until 21st May 1947. Early afternoon signals usually had steady values, assumed to be those which occur when the gradient g of the atmospheric dielectric constant is normal. Abnormal values of g were more favourable to reception on the higher frequencies. The received 700-Mc/s field strength was sometimes abnormally high, particularly when rainstorms occurred near the receiver. Typical records are reproduced and discussed.

621.396.812 : 621.396.97(494) **2893**

Broadcasting Research with F.M. Ultra-Short Waves.—W. Klein & J. Dufour. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st Feb. & 1st April 1948, Vol. 26, Nos. 1 & 2, pp. 1–21 & 61–83. In German.) A comprehensive account of reception tests for transmissions from Chasseral, an elevated station N.E. of Neuchâtel. Three characteristic reception zones were noted. In Zone A, the region of direct radiation, appreciably higher field strengths were observed when using horizontally polarized waves, whereas in Zone B, beyond the optical range, vertical polarization gave the greater signal strength. In Zone C, between A and B, reception was markedly dependent on local conditions. A simple type of directive aerial usually gave a decided improvement in reception in this zone, but made little difference in Zone B. See also 546 of February or 2632 of September (Gerber & Tank).

621.396.812.4.029.64 **2894**

Microwave Propagation Experiments.—L. E. Thompson. (*Proc. Inst. Radio Engrs, W. & E.*, May 1948, Vol. 36, No. 5, pp. 671–676.) One-way propagation tests at frequencies between 3 000 and 4 000 Mc/s are described, for three optical paths. The effect of changes in atmospheric refraction is discussed and methods of reducing signal variations are considered, with special reference to microwave relay communication systems. Theoretical diffraction data are included.

RECEPTION

621.396.621 **2895**

Bush Model EBS4.—(*Wireless World*, June 1948, Vol. 54, No. 6, pp. 214–215.) Test report. Coverage is continuous for λ 10–560 m. Full circuit details are given. The set is designed to withstand tropical conditions.

621.396.621 : 621.396.619.11 **2896**

The Synchrodyne Receiver Again.—(*Radio & Electronics, Wellington, N.Z.*, 1st April 1948, Vol. 3, No. 1, pp. 30–34.) Abridged version of 525 and 526 of February (Tucker).

621.396.621.2 **2897**

Input Circuits for Broadcasting Receivers.—L. de Valroger. (*Rev. tech. Comp. franç. Thomson-Houston*, April 1948, No. 10, pp. 5–30. In French.) Conclusion of 2068 of July.

621.396.621.53 **2898**

Band Spreading by Double Heterodyning.—J. Baumgartner. (*Radio Tech., Vienna*, May 1948, Vol. 24, No. 5, pp. 185–190.) Various techniques for s.w. band spreading are reviewed and a method is described which gives increased sensitivity, is less susceptible to image-frequency interference and gives a linear frequency distribution on all bands.

621.396.81 : 621.396.96 **2899**

Signal-Noise Ratio in Radar.—M. Levy. (*Wireless Engr*, July 1948, Vol. 25, No. 298, pp. 236–237.) Author's reply to criticism of 1146 of April by de Walden (1739 of June).

621.396.82 **2900**

Radio Interference in Ships.—S. F. Pearce. (*Engineer, Lond.*, 12th March 1948, Vol. 185, No. 4807, pp. 261–263.) Details of experiments on interference conducted aboard five merchant ships. The coupling between supply wiring and the aerials, measured at several places on the ship, was -70 ± 13 db. Results indicate that suppression on the ancillary electrical equipment may be reduced to a negligible amount if suitable precautions are taken in the design and layout of the wireless room and nearby supply circuits. High quality reception should be possible when machines of r.f. terminal voltage as high as 5 mV are in operation. See also 2348 of August (Matthews & Borrow).

621.396.82 **2901**

Impulsive Interference in Amplitude-Modulation Receivers.—D. Weighton. (*J. Instn elect. Engrs*, Part III, March 1948, Vol. 95, No. 34, pp. 69–79.) The response of an a.m. receiver to impulsive interference is analysed, using the Fourier integral theorem. The general behaviour of such receivers is deduced from the formulae obtained. The method is applied to the calculation of the performance of noise-suppression circuits, which are classified as amplitude, differential, or delay limiters. Simple expressions are derived for estimating the suppression in any particular case. Experimental results for the first two types are in fair agreement with the calculated values. A comparison is made between the behaviour, under conditions of impulsive interference, of f.m., pulse-length-modulation, and suppressed a.m. systems.

621.396.821 : 551.594.6 **2902**

Pulse Flux defining the Operation Threshold for a Receiver-Recorder of the Mean Level of Atmospherics.—F. Carbenay. (*C. R. Acad. Sci., Paris*, 24th May 1948, Vol. 226, No. 21, pp. 1710–1712.)

621.396.822 **2903**

Some Fundamental Considerations concerning Noise Reduction and Range in Radar and Communication.—S. Goldman. (*Proc. Inst. Radio Engrs, W. & E.*, May 1948, Vol. 36, No. 5, pp. 584–594.) 1947 National Electronics Conference paper. A general analysis of fundamental principles based upon 'information theory' and the theory of probability. Three general theorems concerning the probability relations between signal and noise are proved, and one is applied to investigate the effect of pulse length and repetition rate on radar range. The following subjects are discussed :—(*a*) existing noise-improvement systems, and reasons why more powerful systems should be possible ; (*b*) noise improvement thresholds and their dependence upon a coherence standard ; (*c*) laws governing the maximum operating range of a radar or communication system for a given average power, and general methods of increasing this range ; (*d*) the use of extra bandwidth to reduce distortion ; (*e*) possible relations of this work to biology and psychology.

621.396.822 : 523.16 **2904**

Radio Noise of Extra-Terrestrial Origin and its Effect on the Technique of Telecommunications.—Lehmann. (*See* 2777.)

621.396.822 : 621.317.79 **2905**

Method of Measurement of Noise Ratios and Noise Factors.—van der Ziel. (*See* 2860.)

621.396.828 : 621.396.712 **2906**

Eliminating Interference resulting from Coupled Antennas.—F. E. Butterfield. (*Communications*, March 1948, Vol. 28, No. 3, pp. 18..40.) Serious interference between two 250-W transmitters, operating on frequencies of 1 450 kc/s and 1 490 kc/s respectively and with their aerials 560 ft apart, was practically eliminated by fitting rejection filters in the tuning units of the transmitters. Details of these filters and of their adjustment are given.

STATIONS AND COMMUNICATION SYSTEMS

621.39 : [384 + 620.193.21 **2907**

The Development and Design of Colonial Telecommunication Systems and Plant ; *and* The General Planning and Organization of Colonial Telecommunication Systems.—C. Lawton & V. H. Winson. (*J. Instn elect. Engrs*, Part III, March 1948, Vol. 95, No. 34, pp. 79–87.) Discussion on 1149 and 1150 of April.

621.391.63/.64 **2908**

Survey of Near Infra-Red Communication Systems.—W. S. Huxford & J. P. Platt. (*J. opt. Soc. Amer.*, March 1948, Vol. 38, No. 3, pp. 253–268.) Sixty years' work is reviewed ; only voice and code systems are considered. Discussion of : (*a*) components used and qualities desirable in such systems ; (*b*) early systems developed before World War I in Germany, and, during that war, in America and England ; (*c*) latest equipment developed during World War II in Italy, Japan, Germany and America. A bibliography of 61 papers is included.

621.391.63/.64 **2909**

Principles of Optical Communication Systems.—H. S. Snyder & J. R. Platt. (*J. opt. Soc. Amer.*, March 1948, Vol. 38, No. 3, pp. 269–278.) Factors governing the range of optical communication systems are enumerated and discussed. A general equation relating the range to these factors is derived. Laboratory measurements on components are described; from these the field range of a system may be predicted to within $\pm \frac{1}{4}$ mile if the attenuation due to the atmosphere is known.

621.395.47 **2910**

Multi-Channel Telephony.—(*Elect. Times*, 8th April 1948, Vol. 113, No. 2944, p. 432.) Short account of an I.E.E. paper by R. J. Halsey & J. Swaffield entitled "Analysis-Synthesis Telephony with Special Reference to the Vocoder". The vocoder uses about 10 frequency bands, selected by band-pass filters whose rectified outputs define the energy in the corresponding parts of the speech spectrum. Transmission of these code signals need only occupy a bandwidth of the order of 300 c/s. Details were given of the construction of both the transmitting and receiving equipment, but these details are not included in the present summary.

621.395.47 **2911**

The Potentialities of the Vocoder for Telephony over Very Long Distances.—J. Swaffield. (*P.O. elect. Engrs' J.*, April 1948, Vol. 41, Part 1, pp. 22–28.) A speech analysis-synthesis system whose design and performance are described. Some of the article is taken from the paper noted in 2910 above.

621.396.41 **2912**

A Two-Phase Telecommunication System: Parts 1 & 2.—D. G. Tucker. (*Electronic Engng*, May & June 1948, Vol. 20, Nos. 243 & 244, pp. 150–151 & 192–195.) The fundamental principles of a two-phase transmission system are discussed. Two signals in the same frequency band may be separated on demodulation, provided they are originally modulated with carriers having the same frequency but differing in phase, preferably by $\pi/2$. The demodulation is achieved in each of two branches, by carriers whose phase is such that one signal is eliminated in each branch. Stability of phase throughout the system is essential; methods for achieving this are outlined. Other practical difficulties in the design of a system for single- or multiple-channel working are discussed and suggestions are made for suitable equipment.

621.396.619.15 **2913**

Frequency Shift Telegraphy — Radio and Wire Applications.—J. R. Davey & A. L. Matte. (*Bell Syst. tech. J.*, April 1948, Vol. 27, No. 2, pp. 265–304.) Reprint abstracted in 2362 of August.

621.396.65 **2914**

A Portable Microwave Communication Set.—C. E. Sharp & R. E. Lacy. (*Proc. Inst. Radio Engrs, W. & E.*, May 1948, Vol. 36, No. 5, pp. 676–680.) I.R.E. 1947 National Convention paper. A double concentric transmission-line oscillator valve is used in the transmitter, while the receiver is superregenerative. Duplex operation is provided. The total power consumption is about 20 W and the practical communication range in rolling country is 5 miles. The frequency used is 2 200–2 400 Mc/s.

621.396.65 : 523.3 **2915**

Considerations of Moon-Relay Communication.—D. D. Grieg, S. Metzger & R. Waer. (*Proc. Inst. Radio Engrs, W. & E.*, May 1948, Vol. 36, No. 5, pp. 652–663.) I.R.E. 1947 National Convention paper. Discussion of communication between two places on the earth's surface by means of radio waves reflected from the moon.

621.396.65 : 621.396.41 **2916**

Microwave Radio Communication: Eight-Channel Multiplex Point-to-Point Equipment.—(*Electrician*, 26th March 1948, Vol. 140, No. 3641, p. 963.) A v.m. $\frac{1}{2}$-W transmitting valve for λ 6 cm is used, with pulse-width modulation for the individual channels, which are sampled at a repetition frequency of 9 kc/s. At the receiver the relatively long synchronizing pulse is used to generate a gating pulse in each channel unit. Successful tests have been carried out on an 8-channel link extending 25 miles across London. See also *Wireless World*, May 1948, Vol. 54, No. 5, p. 179.

621.396.65.029.64 **2917**

Experimental Studies of a Remodulating Repeater.—W. M. Goodall. (*Proc. Inst. Radio Engrs, W. & E.*, May 1948, Vol. 36, No. 5, pp. 580–583.) A superheterodyne receiver is used with a microwave reflex-oscillator transmitter to form a repeater. Arrangements are described for testing this system by circulating 1-μs pulses through it and observing the deterioration of the pulse shape after several circulations. Oscillograms show the performance, with and without phase equalization, for 1–30 circulations.

621.396.65.029.64 **2918**

Microwave Repeater Research.—H. T. Friis (Ed.). (*Bell Syst. tech. J.*, April 1948, Vol. 27, No. 2, pp. 183–246.) Discussion of a comprehensive research programme, as yet incomplete, for which the New York/Boston link (1755 and 1756 of June) was an initial objective. Sections by various authors deal with (*a*) propagation studies, (*b*) repeater circuit planning, (*c*) aerial research, (*d*) filter research, (*e*) repeater amplifier, (*f*) receiving converter, (*g*) transmitting converter or modulator, (*h*) r.f. amplifier, and (*i*) the complete repeater.

621.396.65.029.64 **2919**

Repeaters for the New York/Boston Radio Relay System.—A. A. Roetken. (*Bell Lab. Rec.*, May 1948, Vol. 26, No. 5, pp. 193–198.) Each of the seven repeater stations has 4 repeaters, 2 for each direction of transmission. Si rectifiers are used to shift the signal band from 4 000 Mc/s to an i.f. band with mid-frequency at 65 Mc/s. After amplification at this frequency a second varistor modulator is used to shift the frequency back to the microwave range. In the second modulation, an additional shift of 40 Mc/s is provided so that the signals sent out by the repeater are 40 Mc/s higher or lower than those received. Amplitude variations are less than 0.1 db over the 10-Mc/s pass-band and the total noise due to the complete system is barely discernible in a television picture. See also 1755 of June (Durkee).

621.396.65.029.64 **2920**

Terminals for the New York/Boston Radio Relay System.—J. G. Chaffee. (*Bell Lab. Rec.*, March 1948, Vol. 26, No. 3, pp. 97–100.) Each repeater station is provided with equipment which converts received microwave signals to an i.f. of 65 Mc/s, amplifies them and translates them back to microwaves for further transmission. At the terminals, television signals and multiplex telephone and other broadband signals are accepted; from these a modulated i.f. wave is produced and then impressed on the microwave transmission. The necessary equipment is described and a block diagram given. See also 1755 of June (Durkee) and and 1756 of June (J. M.).

621.396.65.029.64 : 621.397.743 **2921**

Two-Way TV Relay.—W. H. Forster. (*Tele-Tech*, April 1948, Vol. 7, No. 4, pp. 46–48.) A wide-band f.m. system between Philadelphia and New York. It operates in the 1 295–1 425-Mc/s band and requires a 20-Mc/s channel. The 84 miles are covered by 3 links with an overall signal/noise ratio of 45 db. A block diagram of the transmitter, receiver and repeater is given and their operation fully described. See also 1756 of June (J. M.).

621.396.712(44) **2922**

Allouis OCIII Centre for Broadcasting on Decametre Waves.—M. Matricon. (*Onde élect.*, April 1948, Vol. 28, No. 253, pp. 121–128.) Details of a new station for world-wide communication, and of its equipment. The station should be in service before the end of 1948. Transmitting power will be not less than 100 kW on the shortest wavelength and will reach 150 kW for λ 50 m. Operating frequencies, which are quartz controlled, range from 6 to 21 Mc/s. 12 rhombic aerials are installed and are fed through a specially designed commutation system which permits various combinations of transmitter connections.

621.396.712(493) **2923**

Speech-Input Equipment of Brussels Broadcasting House.—F. Mortiaux. (*Elect. Commun.*, Dec. 1947, Vol. 24, No. 4, pp. 415–427.) General description of the equipment, which includes 19 studios, 5 recording rooms, and the necessary communication, signalling and supervisory accessories.

621.396.712.3 **2924**

Enlarged WOAI/WOAI-FM Studio Technical Facilities.—C. Jeffers. (*Communications*, March 1948, Vol. 28, No. 3, pp. 12–15..36.) An account of the modifications of existing facilities and the new equipment rendered necessary for dual a.m. and f.m. operation when a f.m. transmitter was installed.

621.396.931 **2925**

The Development of a Radio Communication Network for the South African Railways.—G. D. Walker. (*Trans. S. Afr. Inst. elect. Engrs*, Feb. 1948, Vol. 39, Part 2, pp. 54–58.) Author's reply to discussion on 2942 of 1947.

621.396.932 **2926**

Radio in the Merchant Marine.—J. J. Canavan. (*Electronics*, June 1948, Vol. 21, No. 6, pp. 84–89.) A survey of ship communication equipment. Legal requirements and future developments are considered.

SUBSIDIARY APPARATUS

621.3.013.783† : 621.316.97 **2927**

Screening at V.H.F.—Roston. (*See* 2817.)

621.314.653 : 621.316.722 **2928**

Ignitrons in Broadcast Service.—H. E. Zuvers. (*Tele-Tech*, April 1948, Vol. 7, No. 4, pp. 27–29..70.) A combination of ignitor and grid control can be used to regulate rectifier output voltage and also to provide 'circuit-breaker' action in the ignitrons themselves in case of a fault in the d.c. circuit. The general design of a h.v. sealed ignitron is described and illustrated, and diagrams of ignitron control circuits are given.

621.316.722.1 **2929**

Shunt Voltage Stabilizer.—J. McG. Sowerby. (*Wireless World*, June 1948, Vol. 54, No. 6, pp. 200–203.) Design details for low internal resistance or high stabilization ratio. Bridge and feedback types are considered. See also 1691 of 1939 (Hunt & Hickman) and 2105 of 1939 (Neher & Pickering).

621.316.722.1 **2930**

A Negative-Current Voltage-Stabilization Circuit.—Peilin Luo. (*Proc. Inst. Radio Engrs, W. & E.*, May 1948, Vol. 36, No. 5, p. 583.) The circuit of a stabilizer using two triodes is analysed. With this circuit, stabilization within 0.21% was obtained; the corresponding value for a simpler conventional circuit was 7.5%.

621.317.755 : 778.3 **2931**

An Oscilloscope Camera.—H. E. Hale & H. P. Mansberg. (*Electronics*, June 1948, Vol. 21, No. 6, pp. 102–107.) Continuous records of c.r.o. patterns are made on film or paper at speeds from 1 inch/minute to 5 ft/sec, using electronic motor control.

621.352.1 : 536.48/.49 **2932**

Operation of Lead-Acid Batteries under Extreme Climatic Conditions.—W. Lever. (*Elect. Times*, 18th March 1948, Vol. 113, No. 2941, pp. 329–331.) At 0°F the effective capacity is reduced by as much as 50% of that at 75–80°F; there is a serious risk of freezing of the acid when the battery is discharged; charging is inefficient, on account of higher internal resistance. At high temperatures — above 90°F — serious sulphation may occur with acid of customary specific gravity, so that the working specific gravity must be reduced. Self-discharge rates are also greatly increased.

621.352.7 **2933**

Correlations of the Gel Strength of Paste Walls and the Shelf Life of Electric Dry Cells.—W. J. Hamer. (*Bur. Stand. J. Res.*, March 1948, Vol. 40, No. 3, pp. 251–262.)

621.396.68 : 621.316.722.1 **2934**

A Note on Stabilising Power Supplies.—E. J. Harris. (*Electronic Engng*, March 1948, Vol. 20, No. 241, pp. 96–97.) The Miller circuit uses two double triodes to mix and amplify fractions of the input and output voltages. Both these functions are here performed by a single hexode.

621.396.68 : 621.397.6 **2935**

Television E.H.T. [extra high voltage] **Supply.**—A. H. B. Walker. (*Wireless World*, June 1948, Vol. 54, No. 6, p. 215.) Corrections to 2390 of August.

TELEVISION AND PHOTOTELEGRAPHY

621.397 : 621.383 **2936**

Facsimile Modulator Tube.—Shonnard. (*See* 2961.)

621.397.331.2 : 621.385.832 **2937**

New Viewing Tube for Color TV.—A. Bronwell. (*Tele-Tech*, March 1948, Vol. 7, No. 3, pp. 40–41..65.) The 'Chromoscope' c.r. tube contains a single electron gun and a specially designed colour image screen having four parallel semi-transparent screens which are electrically insulated from each other so as to permit independent control of the screen potentials. The screen nearest the gun is relatively transparent to light and electrons and is given a constant high positive potential, while the other three are coated with phosphors corresponding to the primary colours and are constructed so that one-third of the available electrons strike each screen. Fluorescence occurs on any one colour screen while the others are extinguished if a high positive potential is applied to the screen which is to fluoresce and a low potential to the other two. To obtain a three-colour picture it is merely necessary to apply a high positive potential in turn to the three colour screens.

Observer parallax errors exist, since the three colour screens cannot coincide, but these errors would not be apparent in a projection type of television system.

As electronic switching can be used, the colour interval may be made very small and synchronized with the line sweep frequency. This suppresses the two objectionable characteristics of colour systems known as colour flicker and colour break-up. For another account see *Electronic Engng*, June 1948, Vol. 20, No. 244, pp. 190–191.

621.397.335 **2938**
Television Field Equipment.—J. R. Smith. (*FM & Televis.*, Dec. 1947, Vol. 7, No. 12, pp. 30–32.) A synchronizing generator is described which provides all the timing impulses required to operate one or more television cameras; viz., horizontal and vertical driving signals, and synchronizing and blanking signals.

621.397.5 **2939**
Television D.C. Component.—K. R. Wendt. (*RCA Rev.*, March 1948, Vol. 9, No. 1, pp. 85–111.) A general survey, with reference to transmitter and receiver applications. The relative merits of various restorer circuits are considered. The design of equipment for receiving the signal with the d.c. component present is also discussed.

621.397.5 **2940**
Electro-Optical Characteristics of Television Systems: Introduction & Part 1.—O. H. Schade. (*RCA Rev.*, March 1948, Vol. 9, No. 1, pp. 5–37.) A general review and broad methods of analysis, with discussion of vision and visual systems.

621.397.5 : 535.88 **2941**
Large-Screen Television Projector of the Compagnie des Compteurs.—P. Mandel. (*Bull. Soc. franç. Élect.*, April 1948, Vol. 8, No. 80, pp. 191–200.) Details are first given of the h.f. receiver and video amplifier. The projection c.r. tube uses a maximum voltage of 80 kV and has a mean beam current of 0.5 mA and maximum 2 mA. A special powder is used for the coating of the 20-cm screen. The image is finally projected on a screen made up of a very large number of tiny concave mirrors, whose dimensions are appreciably less than those of an element of a 450-line image. The surface of the screen is concave, the radius being 9 m; the image size is 3 m × 2.25 m.

621.397.5 : 535.88 **2942**
Big Picture Practices.—(*Tele-Tech*, March 1948, Vol. 7, No. 3, pp. 30–35, 67.) A survey of large-size television picture display systems in America, ranging from large direct-viewing c.r. tubes in metal envelopes to optical projection systems and lens magnifiers. No one method seems superior to the others.

621.397.5 : 535.88 **2943**
New Projection Package for Television.—L. J. A. van Lieshout. (*Tele-Tech*, April 1948, Vol. 7, No. 4, pp. 30–33, 56.) A folded adaptation of the Schmidt optical system, designed to fit into cabinets of various sizes. A sealed transformer unit using a ferroxcube core provides a 25-kV second-anode supply for the MW-6 projection tube.

621.397.5 : 791.9 **2944**
Theater Television — a General Analysis.—A. N. Goldsmith. (*J. Soc. Mot. Pict. Engrs*, Feb. 1948, Vol. 50, No. 2, pp. 95–117. Discussion, pp. 118–121.) A descriptive report of the present partly-developed state of the art, with discussion of possible future trends.

621.397.6 **2945**
Film Pickup System.—H. R. Smith & G. S. Gregory. (*FM & Televis.*, March 1948, Vol. 8, No. 3, pp. 31–33 . . 49.) Discussion of equipment for converting pictures obtained from slides or films into the form required for the programme mixing facilities of standard television stations. The equipment consists of an iconoscope scanning unit, control desk and associated power units. Provision is made for the inversion of black and white so that negatives can be used as originals. Special care has been taken to provide easy access for servicing and testing.

621.397.6 : 621.385.832 **2946**
Barrier Grid Storage Tube and its Operation.—Jensen, Smith, Mesner & Flory. (*See* 2986.)

621.397.6 : 621.396.68 **2947**
Television E.H.T. [extra high voltage] **Supply.**—A. H. B. Walker. (*Wireless World*, June 1948, Vol. 54, No. 6, p. 215.) Corrections to 2390 of August.

621.397.61 **2948**
TV Transmitter Design.—G. E. Hamilton. (*Communications*, May 1948, Vol. 28, No. 5, pp. 12–15, 30.) Discussion of design trends, with special consideration of video amplifier and modulator requirements, and modulated amplifier and Class-B linear amplifier stages. The operation of d.c. restorer circuits is also analysed.

621.397.61-182.3 **2949**
How WABD handles Remotes.—O. Freeman. (*Tele-Tech*, March 1948, Vol. 7, No. 3, pp. 42–45, 85.) Description of apparatus and operational procedure for televising sporting and other special events. See also 3685 of 1947.

621.397.62 : 621.385.1 **2950**
Radio-Frequency Performance of Some Receiving Tubes in Television Circuits.—Cohen. (*See* 2971.)

621.397.645 : 621.397.62 **2951**
Selectivity in Television Amplifiers: Problems of Sound-Channel Rejection.—W. T. Cocking. (*Wireless World*, June 1948, Vol. 54, No. 6, pp. 204–207.) To accept the full radiated bandwidth of ± 3 Mc/s the response curve must have a cut-off slope of at least 54 db per Mc/s on the side nearest the sound channel. Single-sideband working and the relative merits of superheterodyne and straight reception are discussed.

621.397.743 : 621.396.65.029.64 **2952**
Two-Way TV Relay.—Forster. (*See* 2921.)

TRANSMISSION

621.316.726.078.3 : 538.569.4 **2953**
Frequency Stabilization with Microwave Spectral Lines.—W. D. Hershberger & L. E. Norton. (*RCA Rev.*, March 1948, Vol. 9, No. 1, pp. 38–49.) I.R.E. 1948 National Convention paper. Absorption lines of gases at reduced pressure exhibit Q values of 100 000 in the 24 000-Mc/s range, and the centre frequency is unaffected by pressure and temperature. Stabilization of a K-band klystron has been effected, using the 23 870.1-Mc/s line of ammonia contained in a short section of matched waveguide, both at the centre frequency of the line itself and at frequencies removed from the line frequency by a controlled intermediate frequency. Indications are that the frequency stability attained compares favourably with that of quartz crystals but with the added advantages that arise from the inherent stability of spectral lines. Applications to a wide range of frequencies in the microwave range, and to a clock of high precision, are indicated.

621.396.61 **2954**
The Mighty Midget [transmitter].—H. L. Apple. (*CQ*, March 1948, Vol. 4, No. 3, pp. 27–30.) Construction, circuit, and operation details of a 35-W fixed or portable transmitter weighing only 3¼ lb, and with overall measurements 3¼ inches by 5 inches by 5¼ inches. Only standard full-size components are used.

621.396.61 : 621.396.41 **2955**

Medium-Power Multichannel Communication Transmitters.—B. T. Ellis. (*Elect. Commun.*, Dec. 1947, Vol. 24, No. 4, pp. 433–435.) A brief description of fractional-kilowatt transmitters for continuous service. Separate r.f. units are used with a common power supply and modulator to provide alternative frequency channels. Six units may be accommodated, giving three frequency bands, 200–540 kc/s, 2–20 Mc/s, and 108–140 Mc/s, on each of which two channels may be used simultaneously, provided that they are not both used for telephony.

621.396.61 : 621.396.712 **2956**

20-kW Broadcasting Transmitters Type TH1392.—C. Beurtheret. (*Rev. tech. Comp. franç. Thomson-Houston*, April 1948, No. 10, pp. 41–49. In French.) Description, with illustrations of particular sections, of a 'Monobloc' transmitter for the range 550–1 560 kc/s. Within the useful modulation range of the transmitter, harmonic distortion is of the order of 1% for all fundamentals from 30 to 5 000 c/s. Background noise is 70 db below the maximum level of modulation.

621.396.61.029.62 **2957**

Engineering a 50-kW F.M. Transmitter.—C. J. Starner. (*Tele-Tech*, April 1948, Vol. 7, No. 4, pp. 42–45, 72.) Discussion of valve and circuit design developments to secure efficient operation in the range 88–108 Mc/s. Grounded-grid circuits are used with air-cooled external-anode triodes Type 7C24 and Type 5592. The exciter unit includes all the frequency-generating, modulating, and frequency-multiplying circuits of the transmitter, except the final doubler. Centre-frequency stability is maintained automatically to within 1 kc/s by comparing a subharmonic of the modulated signal with a standard crystal-controlled frequency, using the frequency difference to operate a correcting device.

621.396.619.23 **2958**

Reducing F.M. Band-Width.—A. G. Chambers. (*Wireless World*, June 1948, Vol. 54, No. 6, pp. 221–222.) Discussion and circuit diagram of a crystal-controlled reactance modulator unit.

VALVES AND THERMIONICS

621.383 **2959**

The Structure of Photo-Sensitive Lead Sulphide and Lead Selenide Deposits and the Effect of Sensitization by Oxygen.—H. Wilman. (*Proc. phys. Soc.*, 1st Feb. 1948, Vol. 60, No. 338, pp. 117–132.) An investigation, by electron diffraction and photoconductivity experiments, of the structure of these deposits, prepared by chemical deposition and by sublimation in vacuo or in oxygen. The PbS and PbSe crystals were found to have a lattice axial dimension which was constant to 0.1% in all samples measured, even in strongly oxidized products. Oxygen treatments increase the sensitivity of PbS to wavelengths of 1–3 μ, but do not do so for PbSe.

621.383 : 535.247.4 **2960**

Concerning the Local Variations of Sensitivity in Photocells.—N. Laycock & G. T. Winch. (*C. R. Acad. Sci., Paris*, 3rd May 1948, Vol. 226, No. 18, p. 1445.) KMV6 and RMV6 photocells can be used for high-precision photometry in spite of the sensitivity variations observed by Terrien, Anglade & Touvay (1814 of June), provided that the measured light is distributed always in the same manner on the cell cathode. The construction of these photocells has recently been modified to reduce local sensitivity variations.

621.383 : 621.397 **2961**

Facsimile Modulator Tube.—J. R. Shonnard. (*Electronics*, June 1948, Vol. 21, No. 6, pp. 82–83.) A new type of photocell with simplified bridge modulator that enables light from the facsimile scanner to produce the modulation directly without generating frequencies that must be eliminated by costly filters. The cell has two flat cathodes which act alternately as cathode and anode. High resolution is obtained, and the output range is more than sufficient for average transmission channels.

621.385.029.63/.64 **2962**

The Theory of the Traveling-Wave Tube.—O. E. H. Rydbeck. (*Ericsson Technics*, 1948, No. 46, 18 pp. In English.) The small-signal theory is developed in detail. The variation of the amplification range of the beam velocity with beam current (J) and diameter is discussed. For small beam currents the gain of the amplified wave component varies as $J^{\frac{1}{3}}$, but in general this gain varies as $J^{\frac{1}{4}}$ and is also proportional to the voltage bandwidth. The characteristic impedances of the helix waves are deduced and the total helix output voltage is computed for a particular case as a function of beam velocity. Interaction between the components of the helix waves produces an output-voltage/beam-velocity curve with a very characteristic shape. This has been proved experimentally. A typical c.r.o. record of such a curve is reproduced. This curve was obtained for $\lambda \simeq 3$ cm with one of the travelling-wave valves developed at the Massachusetts Research Laboratory of Electronics.

621.385.1 **2963**

Anode Current, Noise Factor and Current Modulation of a Valve with Nonlinear Characteristic in Class A, B and C Operation.—H. Kanberg. (*Funk u. Ton*, March–May 1948, Vol. 2, Nos. 3–5, pp. 140–149, 193–207 & 227–243.) A comprehensive mathematical treatment. The amplitudes of all harmonics up to the fifth are calculated for various characteristics defined by different values of m in the formula $I_a = KV^m$, where I_a is the anode current and V the effective control voltage. The results are presented graphically and discussed; curves are also given for the anode-current noise factor.

621.385.1 **2964**

Reflections in Electron Tubes.—J. L. H. Jonker. (*Philips Res. Rep.*, Oct. 1947, Vol. 2, No. 5, pp. 331–339.) The effect of reflected electrons on the electric field between the electrodes is deduced from observations at low potentials. Irregularities in some valve characteristics are thus explained.

621.385.1 **2965**

Special Valves.—M. Alixant. (*Radio tech. Dig., Édn franç.*, April 1948, Vol. 2, No. 2, pp. 95–103.) Operational data for a wide range of valves particularly suitable for television, including also c.r. tubes, Ge and Si rectifiers, and stabilizers.

621.385.1 **2966**

Rugged Electron Tubes.—I. L. Cherrick. (*Electronics*, April 1948, Vol. 21, No. 4, pp. 111–113.) Discussion of: (*a*) the U.S. Joint Army and Navy Electron Tube Specifications for electrical and mechanical stresses that valves must withstand, (*b*) an 'impact machine' for testing valves, (*c*) structural alterations required in Types 6L6GA, 6AC, 2050, 6H6GT and 6AL5, (*d*) reduction of heater failure by using helical coil heaters, (*e*) the use of more rugged clips and stops.

621.385.1 **2967**

Modern Transmitting Valves under Different Operating Conditions.—F. Jenny. (*Brown Boveri Rev.*, June/July 1947, Vol. 34, Nos. 6/7, pp. 139–142.) A brief general survey of properties and modes of operation. Characteristics of the ATL and ATW series of valves, with anode dissipation up to 50 kW, are tabulated.

621.385.1 **2968**

Table of the Characteristics of New European Valves.—(*Radio franç.*, March 1948, pp. 16–17.) Details of the following: triode-hexode frequency changer, UCH41; h.f. pentode with variable slope, UF41; single diode-pentode with variable slope, UAF41; output pentode, UL41; half-wave rectifiers, UY41 and UY42.

621.385.1 : 519.2 **2969**

Notes on the Exponential Distribution in Statistics [of valve life].—Lewis. (*See* 2836.)

621.385.1 : 537.291 **2970**

The Excitation of Resonance Circuits by Electron Streams in the Transit-Time Region.—F. W. Gundlach. (*Arch. elekt. Übertragung*, Nov./Dec. 1947, Vol. 1, Nos. 5/6, pp. 173–183.) A method is described for determining the magnitude of the active and wattless currents arising from the excitation of oscillations in a resonator by the action of periodic electron streams. The intensity and velocity of the streams across the excitation space can depend in any way whatever on the time. Curves are provided to simplify calculation for all commonly occurring cases, including retarding-field excitation.

621.385.1 : 621.397.62 **2971**

Radio-Frequency Performance of Some Receiving Tubes in Television Circuits.—R. M. Cohen. (*RCA Rev.*, March 1948, Vol. 9, No. 1, pp. 136–148.) Measurements of over-all gain, noise, image rejection and oscillator frequency stability were made on a number of valves used in the r.f. amplifiers, mixers and local oscillators of television receivers. Both push-pull and unbalanced circuits are discussed. Measurements were made in the frequency bands 66–72 Mc/s and 198–204 Mc/s.

621.385.1.012.3 : 621.316.722 **2972**

Circuit Design for Gas-Discharge Regulator Tubes.—W. G. Hoyle. (*Tele-Tech*, Feb. 1948, Vol. 7, No. 2, pp. 46–47 . . 72.) Graphical methods for determining circuit parameters to ensure that valves are operated within their normal ratings.

621.385.1.032.216 **2973**

Variation of the Spectral Emissive Power of Oxide Cathodes as a Function of Various Factors.—R. Champeix. (*C. R. Acad. Sci., Paris*, 19th April 1948, Vol. 226, No. 16, pp. 1256–1257.) Experiments show that the emissive power (ϵ_λ) decreases as the thickness of the oxide layer increases. For thin layers ϵ_λ may be 0.35, dropping to 0.05 for thick layers. For layers of the thickness normally used in small valves, about 60–70 μ, ϵ_λ is about 0.2 but varies between 0.1 and 0.3. The spectral emissive power of Ni increases rapidly with temperature but that of oxide cathodes is little affected by temperature or activation. ϵ_λ is slightly lower after activation. See also 1010 of April (Champeix).

621.385.1.032.216 **2974**

Thermionic Emission from Oxide-Coated Cathodes.—F. A. Vick. (*J. sci. Instrum.*, Feb. 1948, Vol. 25, No. 2, pp. 56–60.) A report of the London Summer Meeting of the Electronics Group of the Institute of Physics, 14th June 1947, at which papers describing recent work on the subject were discussed. The use of oxide cathodes for pulse work has led to speculation on the mechanism by which peak saturated current can be many times the normal saturated current at the same temperature. X-ray study of the structure of oxide cathodes shows that during life the surface layers become nearly pure SrO and rectifying barrier-layer compounds are formed at the core/oxide boundary. The resistance of this latter layer has been measured and the potential difference across it at high currents could limit the emission available from the cathode. For a shorter account of the meeting see *Nature, Lond.*, 22nd Nov. 1947, Vol. 160, No. 4073, pp. 725–726.

621.385.15 **2975**

Electron Multiplier Tube of Large Effective Cathode Surface Area.—P. S. Faragó. (*Nature, Lond.*, 10th Jan. 1948, Vol. 161, No. 4080, p. 60.) The effective area is increased by the use of an e.s. lens to project the electron-optical image of a large-surface cathode on the first multiplying electrode of an ordinary multiplier tube.

621.385.2 **2976**

Extension and Application of Langmuir's Calculations on a Plane Diode with Maxwellian Velocity Distribution of the Electrons.—A. van der Ziel. (*Philips Res. Rep.*, Jan. 1946, Vol. 1, No. 2, pp. 97–118.) Langmuir's differential equation for the potential distribution between cathode and anode is extended to the saturated and exponential regions of the characteristic. Formulae are derived relating the transconductance of a diode to the anode voltage and current and to the cathode temperature. The quantity C/C_0 is also calculated for a triode, where C is the equivalent a.c. grid capacitance under operating conditions and C_0 the capacitance when cold. Exact calculation is somewhat difficult, but approximate calculation is greatly simplified by making certain assumptions.

621.385.2 **2977**

Extension of Langmuir's (ξ,η) Tables for a Plane Diode with a Maxwellian Distribution of the Electrons.—P. H. J. A. Kleynen. (*Philips Res. Rep.*, Jan. 1946, Vol. 1, No. 2, pp. 81–96.) Langmuir's tables have been extended by graphical interpolation and by calculation. Graphs show (*a*) the value of the potential minimum as a function of anode current at different cathode temperatures, (*b*) the distance d_m of this minimum from the cathode as a function of anode current at a cathode temperature of 700° C for different values of the saturation current. A table is given whereby similar curves for d_m for other temperatures can be calculated. Examples illustrate the use of the (ξ,η) tables. See also 2976 above.

621.385.3 **2978**

Dimensional Analysis applied to Very-High-Frequency Triodes.—G. Lehmann. (*Elect. Commun.*, Sept. 1947, Vol. 24, No. 3, pp. 391–408.) English version of 3821 of 1946.

621.385.3 **2979**

The Dyotron Microwave Oscillator.—(*Communications*, May 1948, Vol. 28, No. 5, pp. 24–25.) Summary of I.R.E. 1948 National Convention paper by E. D. McArthur noted in 2663 of September. A new type of u.h.f. valve, which is unusually stable, has a very wide tuning range and can be used in local oscillators. A 70-pF capacitor connects grid and cathode inside the valve, which otherwise is similar to the 2C39 triode. Experiments are described in which a single coaxial cavity with a piston tuner is used; a continuous tuning range of 370–3 700 Mc/s is obtained.

621.385.3 **2980**

A.C. Operated Triodes.—A. Grainge. (*Electronic Engng*, June 1948, Vol. 20, No. 244, pp. 178–180.) A graphical method for predicting the operating conditions of a triode which derives anode voltage from a.c. mains. The method is used to design a sensitive relay for the indirect control of a 2-kW load.

621.385.4.029.62/.63 **2981**

500-Mc/s Transmitting Tetrode Design Considerations.—W. G. Wagener. (*Proc. Inst. Radio Engrs, W. & E.*, May 1948, Vol. 36, No. 5, pp. 611–619.) I.R.E. 1947 National Convention paper. Discussion of characteristics of a power amplifier for the 30–500-Mc/s band and of the relative merits of triodes and tetrodes in this range. For tetrodes, self-neutralization occurs at a particular frequency, which can be adjusted by external circuit arrangements. Tetrodes are preferred to neutralized triodes, chiefly on the ground of greater stability. Two new transmitting tetrodes are described.

621.385.5 : 621.395.92 **2982**

Hivac Miniature Valves.—O. P. Herrnkind. (*Funk u. Ton*, May 1948, Vol. 2, No. 5, pp. 254–259.) Data and characteristics of XW 0.75A and B pentodes for initial stages and of XY 1.4A, B & C output pentodes. These valves are particularly suitable for use in hearing aids on account of their small size and low current consumption.

621.385.832 **2983**

An Image Storage Tube.—(*Electronics*, May 1948, Vol. 21, No. 5, pp. 132, 134.) Extract from *Air Technical Intelligence Tech. Data Digest*, 1st July 1947, p. 11. Description of the Krawinkel storage tube developed in Germany. The writing beam charges up a storage plate of small capacitors which can remain charged for three weeks. The storage surface may be scanned and an image projected on to a fluorescent screen. Leakage is minimized by incorporating in the tube a triode with a getter-coated anode, to maintain a high vacuum.

621.385.832 : 535.767 **2984**

Stereoscopic Viewing of Cathode-Ray Tube Presentations.—H. A. Iams, R. L. Burtner & C. H. Chandler. (*RCA Rev.*, March 1948, Vol. 9, No. 1, pp. 149–158.) Discussion of : (*a*) two methods of presenting 3-dimensional information on c.r. tubes, with examples of oscillograms and radar presentations in 3 dimensions, (*b*) the effect of flicker on stereoscopic viewing, and (*c*) possible applications.

621.385.832 : 621.396.96 **2985**

The Visibility of Signals on Radar Range Presentations.—E. R. Andrew. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 10, pp. 1559–1563.) An investigation of the dependence of the minimum detectable signal on parameters of the equipment, such as pulse length, bandwidth, timebase speed and brightness of the oscilloscope trace.

621.385.832 : 621.397.6 **2986**

Barrier Grid Storage Tube and its Operation.—A. S. Jensen, J. P. Smith, M. H. Mesner & L. E. Flory. (*RCA Rev.*, March 1948, Vol. 9, No. 1, pp. 112–135.) Two c.r. tubes, one with e.m. and one with e.s. focusing and deflection systems, have been designed for storing video signals electrostatically on an insulating screen. Methods of measurement of the tube characteristics are described and the theory of operation is discussed. After storage times of up to 100 hours there was no evidence of distortion or decay.

621.396.615.141.2 **2987**

Low-Power Resonant-Segment Magnetrons for Centimetre Waves.—J. C. Dix & E. C. S. Megaw. (*J. Instn elect. Engrs*, Part IIIA, 1946, Vol. 93, No. 10, pp. 1585–1592.) The development and use of a range of small glass magnetrons having anode systems consisting of a number of interleaved segments. Characteristics of Types E1210, CV79 and CV89 are given, together with descriptions of the associated circuits. Methods of modulation, particularly pulse-width modulation, are also discussed.

621.396.615.142.2 **2988**

Multifrequency Bunching in Reflex Klystrons.—W. H. Huggins. (*Proc. Inst. Radio Engrs, W. & E.*, May 1948, Vol. 36, No. 5, pp. 624–630.) Webster's simple bunching theory is extended to include simultaneous oscillations in a reflex klystron at two or more frequencies. General expressions for the power and electronic admittance are derived that show the intermodulation effects of the oscillations upon each other.

621.314.63 **2989**

Crystal Rectifiers. [Book Review]—H. C. Torrey & C. A. Whitmer (Eds). McGraw-Hill, New York, 1948, 443 pp., $7.50. (*Electronics*, June 1948, Vol. 21, No. 6, pp. 248, 250.) Vol. 15 of the M.I.T. Radiation Laboratory series. The object is " to present the fund of knowledge on crystal rectifiers that accumulated during the course of World War II ".

MISCELLANEOUS

621.3 **2990**

Electrical Research.—(*Engineer, Lond.*, 20th Feb. 1948, Vol. 185, No. 4804, p. 182.) A report of some of the activities of the British Electrical and Allied Industries Research Association during 1947.

621.3(083.74) **2991**

Standard Terms and Abbreviations.—H. Jefferson : A. L. Meyers. (*Wireless Engr*, July 1948, Vol. 25, No. 298, p. 236.) Comment on 2426–2428 of August.

621.38 : 519.283 **2992**

Statistical Methods in the Design and Development of Electronic Systems.—L. S. Schwartz. (*Proc. Inst. Radio Engrs, W. & E.*, May 1948, Vol. 36, No. 5, pp. 664–670.) I.R.E. 1948 National Convention paper.

621.395 **2993**

Progress of Telecommunication Services in British Post Office.—(*Elect. Commun.*, Sept. 1947, Vol. 24, No. 3, pp. 300–309.) A general review of the British telephone service with brief reference to oversea radio links and ship-to-shore radiotelephone systems.

621.396 **2994**

Radio Progress during 1947.—(*Proc. Inst. Radio Engrs, W. & E.*, April 1948, Vol. 36, No. 4, pp. 522–550.) " This summary for 1947 covers generally, for the subjects dealt with, developments described in publications issued up to about the first of November. The material has been prepared by members of the 1947 Annual Review Committee of the Institute, with editing and co-ordinating by the Chairman." A bibliography of 689 references arranged under broad subject headings is given.

621.39 **2995**

The Fundamental Research Problems of Telecommunications. [Book Notice]—Department of Scientific and Industrial Research. H.M. Stationery Office, London, March 1948, 80 pp., 1s. 6d. (*Govt Publ., Lond.*, April 1948, p. 16.) Comprises the reports of the nine working parties set up by the Telecommunications Research Committee (chairman : Sir Stanley Angwin).

621.396(075.8) **2996**

Radio Engineering. [Book Review]—F. E. Terman. McGraw-Hill, New York and London, 3rd edn 1947, 969 pp., $7.00. (*Proc. Inst. Radio Engrs, W. & E.*, April 1948, Vol. 36, No. 4, pp. 511–512.) The coordination and combination with older material of developments in radio engineering in the last ten years has been so accomplished that " the whole is incorporated within the covers of a single volume suitable for classroom use of engineering seniors ". Fundamental principles are emphasized throughout.

ABSTRACTS and REFERENCES

Compiled by the Radio Research Board and published by arrangement with the Department of Scientific and Industrial Research

The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to it.

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ACOUSTICS AND AUDIO FREQUENCIES

534.21 **2997**

Directional Characteristic of a Cylindrical Radiator with a Coaxial Conical Reflector.—G. Bacchi. (*Alta Frequenza*, April 1948, Vol. 17, No. 2, pp. 74–78. In Italian with English, French and German summaries.) Magnetostriction oscillators of the above type, adapted for radial vibration, have radiation patterns with an absolute maximum along the axis. The wavelength is of the same order as the dimensions of the cylinder. The radiation pattern is calculated. With a 45° cone the characteristic is represented by the integral of Bessel's function of zero order.

534.242 **2998**

Formula involving the Shape for Calculating the Resonance Frequency of Helmholtz Resonators.—D. Chervet & J. Henry. (*C. R. Acad. Sci., Paris*, 7th June 1948, Vol. 226, No. 23, pp. 1891–1893.) Rayleigh's formula was established on the assumptions that the pressure inside the resonator is constant and that the resonator dimensions are small compared with the resonance wavelength. Measurements show that the pressure varies from point to point according to an exponential law, the maximum pressure being at the bottom of the resonator. From this a correction formula is derived which is not easy to use and can be replaced by an empirical formula involving simply the product of the resonator length L and the resonance frequency f_0 given by Rayleigh's formula. Experimental results for resonators of various shapes are tabulated, together with the frequencies calculated from Rayleigh's formula and the two correction formulae.

534.321.9 **2999**

Distortion of Progressive Ultrasonic Waves.—J. C. Hubbard, J. A. Fitzpatrick, B. T. Kankovsky & W. J. Thaler. (*Phys. Rev.*, 1st July 1948, Vol. 74, No. 1, pp. 107–108.) Spark shadow photographs of ultrasonic waves in air, water, glycerine and CCl_4 show definite changes of waveform into a type with steeper fronts and increased harmonic content.

534.321.9 : 621.391.63 **3000**

Distortion in Light Modulation by an Ultrasonic Cell.—D. Sette. (*Alta Frequenza*, April 1948, Vol. 17, No. 2, pp. 51–68. In Italian with English, French and German summaries.) Description of an 8-Mc/s cell similar to that of Giacomini (1847 of July). Frequency distortion in a modulated light beam transmitted through the cell is small even for comparatively high modulation frequencies. The low distortion and the high modulation factor possible are particular advantages of such a system.

534.321.9.001.8 : 614.8 **3001**

Notes on Using High-Power Ultrasonics.—White. (*See* 3195.)

534.75 **3002**

Audibility of High-Frequency Sounds.—V. Gavreau. (*C. R. Acad. Sci., Paris*, 21st June 1948, Vol. 226, No. 25, pp. 2053–2054.) It is found that sounds of frequencies from 17.5 kc/s to 26 kc/s are perfectly audible when sufficiently intense. When the intensity of such sounds is steadily increased, one or more sudden apparent changes of pitch, of about an octave, are observed. These apparent changes of pitch may be due to abrupt changes in the order of the harmonic response of the resonators of the ear. Magnetostriction oscillators were used and gave sound powers up to 5 W.

534.756.1 **3003**

Phase Memory of the Ear : A Proof of the Resonance Hypothesis.—R. J. Pumphrey & T. Gold. (*Nature, Lond.*, 24th April 1948, Vol. 161, No. 4095, p. 640.) Two alternative trains of sine-wave pulses are used. Each pulse contains n cycles, the pulse separation being m cycles, where m and n are both integers. In one train the phase of all pulses is the same, while in the other the phase of alternate pulses is reversed. The ear can differentiate between the two trains. It follows that the value of Q for the resonators of the ear must be at least 100 and is probably considerably higher. See also 8 of January.

534.83 **3004**

Acoustic Materials.—(*Electronics, Buyers' Guide Issue*, June 1948, Vol. 21, No. 6A, pp. M2–M3.) Noise reduction coefficients of various sound-absorbing materials are tabulated and compared with those of ordinary building materials. Mountings used in sound absorption tests are briefly discussed.

534.839 **3005**

Methods for the Study of Noise.—A. Moles. (*Radio franç.*, June 1948, pp. 9–15.) Subjective and objective methods are discussed, the principal characteristics of various types of microphone are considered and a description of the General Radio decibel meter is given. Harmonic analysers are also considered briefly.

534.851 : 621.395.813 **3006**

Measuring Wow.—U. R. Furst. (*FM & Televis.*, May 1948, Vol. 8, No. 5, pp. 30, 50.) Discussion of methods of measurement, and description of a commercial type of meter.

534.861.1 : 621.316.345 : 621.396.664 **3007**

Modern Design Features of C.B.S. Studio Audio Facilities.—Monroe & Palmquist. (*See* 3241.)

534.861.1 : 621.396.712.3 **3008**

Speech-Input Equipment for New Oslo Broadcasting House.—E. Julsrud & G. Weider. (*Elect. Commun.*, March 1948, Vol. 25, No. 1, pp. 21–29.) An illustrated description, giving details of the facilities available. Easy, flexible and reliable operation is ensured by extensive use of automatic switching.

621.395.623.7.015.3 **3009**

Study of Loudspeakers in the Transient Regime.—G. Guyot. (*Rev. gén. Élect.*, June 1948, Vol. 57, No. 6, pp. 245–253.) Discussion of the response of loudspeakers to steady tones, with methods of obtaining the corresponding curves, and a detailed account of test methods and results for square-shape sine-wave signals and for pulse signals. Preliminary results indicate a correlation between the quality appreciated by the ear and the duration of the transient signal. For a loudspeaker 21 cm in diameter, signal quality was found to fall off if the duration of the pulse signal was below about 2.7 ms. Discussion of the various methods of testing loudspeakers shows that transient tests cannot replace ordinary methods completely, but that they furnish valuable information as to loudspeaker quality.

621.395.625.3 **3010**

Two-Channel Two-Way-Drive Magnetic Tape Recorder.—R. E. Zenner & R. B. Vaile, Jr. (*Audio Engng, N.Y.*, April 1948, Vol. 32, No. 4, pp. 11–15.) Designed for good performance at low tape speed.

621.395.625.3 **3011**

Test Characteristics of Recording Wire.—Carter & Koontz. (*See* 3149.)

621.395.625.6 : 621.317.75.015.3 **3012**

Sweeping Device for the Display of Transient Phenomena and Nonlinear Distortion.—Meyer-Eppler. (*See* 3183.)

AERIALS AND TRANSMISSION LINES

621.315 **3013**

Transmission Line Theory Simplified.—W. Redmayne. (*Distrib. Elect.*, April 1948, Vol. 20, No. 170, pp. 346–348, 350.) The general equations for voltage and current at any point of a d.c. transmission system are derived without using differential equations. Both loaded and unloaded lines are considered. The equations can be easily adapted to the case of a.c. transmission.

621.315.2.017.71 **3014**

Heating of Radio-Frequency Cables.—W. W. Macalpine. (*Elect. Commun.*, March 1948, Vol. 25, No. 1, pp. 84–99.) Discussion with particular reference to solid-dielectric coaxial cables; only the simplest physical or mathematical assumptions are made.

621.315.23 : 620.197.6 **3015**

Rubber Thermoplastic Jacket for Buried Cable.—C. V. Lundberg. (*Bell Lab. Rec.*, April 1948, Vol. 26, No. 4, pp. 148–151.) Protection of the lead casing of cables against corrosion is secured by two layers of a material made from reclaimed rubber, clay, resin, paraffin wax and mineral rubber. A fabric tape, corrugated Cu sheath and bitumen layer are applied outside the rubber.

621.392.029.64 **3016**

Attenuation of the H_{10} Wave in a Rectangular Waveguide.—N. N. Malov. (*Zh. tekh. Fiz.*, April 1948, Vol. 18, No. 4, pp. 417–420. In Russian.) Discussion of a method based on an examination of the multiple reflection of the transverse wave from the walls of the waveguide. It is shown that the H_{m0} and H_{0n} types of wave cannot be regarded as particular cases of the H_{mn} type with m or n zero.

621.392.029.64 **3017**

The Excitation of a Rectangular Waveguide through a Slot.—I. I. Vol'man. (*Radiotekhnika, Moscow*, May/June 1948, Vol. 3, No. 3, pp. 49–55. In Russian.) Methods are indicated for calculating the field produced between two parallel planes by energy supplied through an aperture. The results obtained can be applied in the theory of rectangular waveguides.

621.392.029.64 **3018**

Effect of Junctions on the Field in a Waveguide.—H. Buchholz. (*Arch. elekt. Übertragung*, Jan. 1948, Vol. 2, No. 1, pp. 14–22.) Formulae are derived for the effect of a narrow circumferential slot in the wall of a waveguide on the transmission of waves having an axial component of wall current.

621.392.029.64+621.396.611.4] : 621.3.015.3 **3019**

Study of the Transient Regimes in Waveguides and Cavity Resonators.—T. Kahan & S. Colombo. (*C. R. Acad. Sci., Paris*, 21st June 1948, Vol. 226, No. 25, pp. 2060–2061.) A method is given which enables formulae applicable to the transient state to be derived from formulae established for the steady state with frequency $\omega/2\pi$.

621.392.029.64 : 621.317.3 **3020**

On the Representation and Measurement of Waveguide Discontinuities.—N. Marcuvitz. (*Proc. Inst. Radio Engrs, W. & E.*, June 1948, Vol. 36, No. 6, pp. 728–735.) The various equivalent circuit representations of a general 2N-terminal waveguide structure, obtained by selection of different terminal planes, are discussed and interrelated. A precision method of measuring the circuit parameters of such structures is described. Weissfloch's tangent relation for the input/output behaviour of a four-terminal waveguide structure is used.

621.392.029.64 : 621.396.67 **3021**

The Theory of the Ring Resonant Slot in a Waveguide.—M. L. Levin. (*Zh. tekh. Fiz.*, May 1948, Vol. 18, No. 5, pp. 639–652. In Russian.) A theoretical analysis is given of a resonant slot aerial having the form of a narrow ring cut in the wall of a semi-infinite waveguide of circular cross-section.

621.392.43 : 621.317.72 **3022**

A Modified Micromatch.—Corfield & Cragg. (*See* 3176.)

621.396.67 **3023**

Relations between the Transmitting and Receiving Properties of Antennas.—A. F. Stevenson. (*Quart. appl. Math.*, Jan. 1948, Vol. 5, No. 4, pp. 369–384.) A rigorous mathematical discussion. The parasitic and receiving properties of a perfectly conducting aerial can be derived from its transmitting properties under stated conditions. The particular case of a linear aerial in a homogeneous isotropic medium is considered in detail. A rigorous proof of Thévenin's theorem for aerials is given without any appeal to circuit theory. The polar diagram of an aerial used for transmission is not in general identical with that of the same aerial used for reception, though these polar diagrams are approximately identical in practical cases. Reciprocal relations between two aerials are discussed. The case of an imperfectly conducting aerial is also briefly considered.

621.396.67 **3024**

Calculation of the Field Strength produced by a Half-Wave Aerial at a Given Point above a Plane Earth as a Function of the Energy supplied per Second: Part 1.—K. F. Niessen. (*Physica, 's Grav.*, July 1940, Vol. 7, No. 7, pp. 586–602. In German.) Formulae are derived for the vertical field due to a $\lambda/2$ aerial with its foot at a given distance above a plane earth, taking account of the energy absorbed in the earth. Numerical results are given for various assumed values of earth conductivity and dielectric constant. See also 3025 below.

621.396.67 **3025**

Electric Field Strength as a Function of the Energy supplied to the Aerial :Part. 2 — K. F. Niessen. (*Physica, 's Grav.*, Dec. 1940, Vol 7, No. 10, pp. 897–908. In German.) Calculations are made for the same wavelength and geometrical ratios as those of part 1 (3024 above), but for values of the earth conductivity ρ and dielectric constant ϵ corresponding to dry ground. The results are compared with those of part 1 and discussed. Tables give the vertical field, due to a vertical $\lambda/2$ aerial with its foot at a height of $\lambda/4$ above a plane earth, at a distance of 5λ and a height of $\lambda/4$, for various values of ϵ and ρ, and also the corresponding fields due to a dipole. For high values of ρ the corrected reflection formula should be used, particularly when ϵ is small; for low values of ρ, Sommerfeld's formula is preferable.

621.396.67 **3026**

The Cylindrical Antenna with Gap.—R. King & T. W. Winternitz. (*Quart. appl. Math.*, Jan. 1948, Vol. 5, No. 4, pp. 403–416.) The King-Middleton theory (1453 and 3547 of 1946) is generalized to show the effect of a finite gap on the current and the impedance of a cylindrical aerial with a gap of length 2δ between the halves of the aerial. For small gaps the impedance is not very sensitive to gap length, so that impedances calculated for zero gap are good approximations for aerials for which $2\pi a\delta/\lambda_0 < 0.01$, a being the radius of the conductors. For gap lengths not satisfying this inequality, correction curves are given for use with curves for resistance and reactance.

621.396.67 **3027**

The Field of a Dipole with a Tuned Parasite at Constant Power.—R. King. (*Proc. Inst. Radio Engrs, W. & E.*, July 1948, Vol. 36, No. 7, pp. 872–876.) Theoretical curves are given for the electric field, in the forward and backward directions, of a centre-driven $\lambda/2$ dipole with a parallel centre-tuned reflector of the same dimensions, for various values of aerial spacing and reflector impedance.

621.396.67 : 517.392 **3028**

Concerning a New Transcendent, its Tabulation and Application in Antenna Theory.—Bouwkamp. (*See* 3158.)

621.396.67 : 517.512.2 **302**

Fourier Transforms in Aerial Theory: Part 6.—Ramsay. (*See* 3159.)

621.396.671 **3030**

The Radiation Resistance of End-Fire and Collinear Arrays.—C. H. Papas & R. King. (*Proc. Inst. Radio Engrs, W. & E.*, June 1948, Vol. 36, No. 6, pp. 736–741.) Formulae obtained for this resistance involve circular functions and can conveniently be used for computation. The only mathematical approximation is a Fourier representation of the field of a single $\lambda/2$ dipole, discussed in 3326 of 1941 (King). The new formulae are in satisfactory agreement with the results of Pistolkors and Bontsch-Bruewitsch.

621.396.677 **3031**

Note on Practical Limitations in the Directivity of Antennas.—R. M. Wilmotte. (*Proc. Inst. Radio Engrs, W. & E.*, July 1948, Vol. 36, No. 7, p. 878.) Discussion on 2731 of October (Riblet).

621.396.677 **3032**

Artificial Dielectric Lenses for Microwaves.—W. E. Kock. (*Bell Lab. Rec.*, April 1948, Vol. 26, No. 4, pp. 145–147.) For a fuller account see 2176 of August.

CIRCUITS AND CIRCUIT ELEMENTS

621.3.015.3 : [621.392.029.64 + 621.396.611.4 **3033**

Study of the Transient Regimes in Waveguides and Cavity Resonators.—Kahan & Colombo. (*See* 3019.)

621.314.2 : 621.395.623.7 **3034**

Study of the Output Transformer for Feeding Loudspeakers.—L. Chrétien. (*T.S.F. pour Tous*, July/Aug. 1948, Vol. 24, Nos. 237/238, pp. 185–188.) Discussion of the conditions which should be satisfied for optimum performance, with faithful reproduction of both high and low frequencies. Practical design details are considered briefly.

621.314.2 : 621.396.813 **3035**

Nonlinear Distortion in Low-Frequency Transformers with Strong Premagnetization.—F. Böttcher. (*Frequenz*, May 1948, Vol. 2, No. 5, pp. 140–143.) The distortion occurring in the load resistance is calculated under certain simplifying assumptions. The effective magnetization curve showing the relation between induction and field strength, taking account of the airgap, is thereby replaced approximately by a parabola. Values are thus derived for the harmonic and combination tones of the quadratic distortion in the secondary load, when two sine-wave tones are applied to the transformer primary.

621.316.86 **3036**

Thermistors and their Applications.—B. S. Sotskov. (*Avtomatika i Telemekhanika*, Jan./Feb. 1948, Vol. 9, No. 1, pp. 39–58. In Russian.) The properties of various types are tabulated, and discussed in detail under the following headings: (*a*) main characteristics, (*b*) effect of size and shape on parameters, (*c*) determination of steady-state and transient regimes in thermistor circuits, and (*d*) applications to (i) time delay relays, (ii) starting resistances for motors, (iii) shunting resistances for lamps and other current-carrying devices connected in series, (iv) voltage stabilizers, (v) temperature measurements, (vi) gas and liquid flow measurements, (vii) bolometers and (viii) rheostats. See also 765 or 3552 of 1947 (Becker, Green & Pearson), and 3044 of 1947 (Rosenberg).

621.318.572 : 621.385.38 **3037**

A Fast, Noiseless Thyratron Switch.—S. W. Kitchen. (*Rev. sci. Instrum.*, May 1948, Vol. 19, No. 5, pp. 370–371.) The cathode resistor of a conventional thyratron switch is replaced by a capacitor and a resistor of only 100 Ω is used in the anode circuit. With this arrangement, if the desired current drain through the switch is small compared with the rated average thyratron current, inherent noise is eliminated while fast action is retained.

621.392 : 518.4 **3038**

Design Curves for Parallel-T Network.—D. Espy. (*Electronics*, July 1948, Vol. 21, No. 7, pp. 114–115.) Generalized curves from which transmissions at various deviations from resonant frequency can be read directly. Design equations are also given.

621.392 : 621.396.645.029.64 **3039**

Very-High-Frequency Triode Oscillator and Amplifier Circuits.—G. Lehmann. (*Elect. Commun.*, March 1948, Vol. 25, No. 1, pp. 50–61.) Translation of paper abstracted in 368 of 1947.

621.392.011.2 **3040**

A Contribution to the Approximation Problem [for impedance functions].—R. F. Baum. (*Proc. Inst. Radio Engrs, W. & E.*, July 1948, Vol. 36, No. 7, pp. 863–869.) An approximation to the curve of a given impedance function can be obtained by combining a finite number of 'semi-infinite slopes', represented by Butterworth functions. The labour normally involved in the calculation of impedance zeros and poles is thus greatly reduced. Tschebyscheff functions are more appropriate for obtaining approximations to filter curves. Approximations to resistance, reactance and phase curves can be obtained similarly.

621.392.088.7 **3041**

The Theory and Design of Thermal Compensation of a Circuit for a Given Frequency Range.—S. S. Arshinov. (*Radiotekhnika, Moscow*, March/April 1948, Vol. 3, No. 2, pp. 21–39. In Russian.) The problem of reducing as much as possible the maximum value of the temperature coefficient for a given frequency range is a particular case of finding the best approximation to a continuous function. Conditions for optimum thermal compensation in simple and complex circuits are here derived from a formula due to Tchebyschev. Complete compensation is possible for the whole operating range. A numerical example is given.

621.392.43 : 621.314.2 **3042**

Impedance Matching Half-Wave Transformer.—H. E. Dinger & H. G. Paine. (*Tele-Tech*, May 1948, Vol. 7, No. 5, Part 1, pp. 41–43, 77.) A transformer for matching a balanced load to an unbalanced source of the same impedance, using a λ/2 coaxial line. Since such lines can be used at 20% off resonance with an impedance change of only 5%, continuous coverage for the frequency range 100–400 Mc/s is achieved with 4 interchangeable lines.

621.392.5 : 621.385.3 : 512.831 **3043**

The Application of Matrices to Vacuum-Tube Circuits.—J. S. Brown & F. D. Bennett. (*Proc. Inst. Radio Engrs, W. & E.*, July 1948, Vol. 36, No. 7, pp. 844–852.) The matrix equations for triode circuits are derived for linear operation with any one electrode grounded. A table relating matrix elements is calculated, allowing for the fact that the networks are not bilateral. Formulae are obtained for the gain of an amplifier having m identical stages. Two examples showing the advantages of the matrix method are included.

621.396.611 : 621.316.729 **3044**

Pseudosynchronization in Amplitude-Stabilized Oscillators.—P. R. Aigrain & E. M. Williams. (*Proc. Inst. Radio Engrs, W. & E.*, June 1948, Vol. 36, No. 6, pp. 800–801.) If a frequency f is injected into an amplitude-stabilized oscillator of frequency f_0, then over a band of frequencies for which $|f - f_0|$ is small, f_0 disappears and the system acts as a regenerative amplifier for the injected signal and 'pulling' does not exist. These results are contrasted with those of Adler (2522 of 1946).

621.396.611.015.4 **3045**

Notes on a Property of the Voltage Resonance of an Oscillatory Circuit.—E. Fromy. (*Onde élect.*, June 1948, Vol. 28, No. 255, pp. 218–221.) Starting from the elementary equations of an oscillatory circuit fed by a sinusoidal source, it is shown that the terminal voltage can be regarded as the sum of two voltages, whose amplitudes are constant and equal to half the terminal voltage of the circuit at resonance ; one voltage is of constant phase, while the phase of the other varies on either side of the phase at resonance, according to the value of the tuning capacitance. This property is quite general and is established without making any simplifying assumptions ; it can have numerous practical applications, particularly in the design of dephasing circuits.

621.396.611.1 **3046**

The Application of the Symbolic Method to the Analysis of the Free Régime of Linear Systems.—A. A. Rizkin. (*Radiotekhnika, Moscow*, May/June 1948, Vol. 3, No. 3, pp. 56–63. In Russian.) A general analytical method is proposed which is based on breaking the circuit under consideration at some point and determining the input impedance at this point. By equating this 'characteristic' impedance to zero or infinity (depending on the properties of the circuit) a characteristic equation of the circuit is obtained. Five examples of the application of this method are given.

621.396.611.1 **3047**

The Starting of Oscillations in RC Generators.—G. Gillard. (*T.S.F. pour Tous*, May 1948, Vol. 24, No. 235, pp. 132–134.) A non-mathematical explanation.

621.396.611.21 **3048**

Series Mode Crystal Circuits.—H. Goldberg & E. L. Crosby, Jr. (*Tele-Tech*, May 1948, Vol. 7, No. 5, Part 1, pp. 24–27, 86.) The equivalent circuit of a piezoelectric quartz crystal near resonance is considered ; in a typical crystal the series and parallel resonant frequencies are close together. A 118-Mc/s direct-operation circuit including a 7F8 twin triode is described ; the eleventh mechanical harmonic of the crystal is used. This circuit can be modified for use as a converter.

621.396.611.21 **3049**

On the Equivalent Circuit and Performance of Plated Quartz Bars.—J. K. Clapp. (*Gen. Radio Exp.*, March/April 1948, Vol. 22, Nos. 10/11, pp. 1–7.) The impedance and equivalent electric circuit are derived for a long bar. Both mechanical and electrical stability for l.f. modes of vibration are improved by the use of tension mounting and by operation at the second harmonic. Zero temperature coefficient can be obtained for a particular temperature.

621.396.611.4 **3050**

On the Design of Circuits Equivalent to Cavity Resonators.—N. N. Malov. (*Zh. tekh. Fiz.*, April 1948, Vol. 18, No. 4, pp. 421–430. In Russian.) The conditions of equivalence are defined and a general design method is discussed ; this is used to determine a circuit equivalent to a cylindrical resonator in which a standing wave of the H_{011} type is present.

621.396.611.4 **3051**

A Method of Feeding Microwave Power into a Resonator having a Fine Mode Structure.—G. R. Newbery & W. E. Willshaw. (*Nature, Lond.*, 3rd April 1948, Vol. 161, No. 4092, pp. 519–520.) Power was fed into a 24-cavity resonator 120 cm long, the frequency separation between the required mode of operation and the adjacent mode being only 0.2% (6 Mc/s). The required mode had a phase difference of π between currents in adjacent cavities. A pulsed magnetron, Type E1944, was driven at 500 pulses/sec, with 2-μs pulses, by an Admiralty Type 277 modulator with a peak output of 1.25 MW. An estimated peak power of 390 kW was fed into the resonator.

621.396.615 **3052**

Use of Ordinary Valves as Microwave Oscillators.—G. Fonda-Bonardi. (*Alta Frequenza*, April 1948, Vol. 17, No. 2, pp. 69–73. In Italian with English, French and German summaries.) The power output of an oscillator using an ordinary valve becomes zero when the oscillation frequency is so high that the electron transit time is a substantial fraction of the oscillation period. Oscillations can be obtained, however, when the transit time is a multiple of the oscillation period. A circuit using a 6V6 valve with a Lecher-line oscillatory circuit is described, with which frequencies from 1 000 Mc/s to 3 000 Mc/s have been obtained.

621.396.615 **3053**

The Self-Modulation of Auto-Oscillations in a Valve Oscillator with Automatic Biasing in the Cathode Circuit.—N. A. Zheleztsov. (*Zh. tekh. Fiz.*, April 1948, Vol. 18, No. 4, pp. 495–508. In Russian.) An analysis of the operation of the oscillator depicted in Fig. 1, using simplified valve characteristics and the van der Pol method of 'abbreviated' equations. Methods are indicated for determining the amplitude of auto-oscillations and the conditions necessary for the appearance of self-modulation are found. Photographs are shown of phase trajectories on the van der Pol plane, obtained with a c.r.o. The gradual appearance of self-modulation is thus confirmed experimentally.

621.396.615 **3054**

An Investigation of a Relaxation Oscillator of the Transitron Type.—V. V. Migulin & T. N. Yastrebtsova. (*Zh. tekh. Fiz.*, May 1948, Vol. 18, No. 5, pp. 603–614. In Russian.) An experimental investigation in which an external sinusoidal e.m.f. is applied to a RC oscillator operating in the regime of free auto-oscillations. Results are in good agreement with the theory of such oscillators, which is also discussed.

621.396.615.14 : 621.316.726.078.3 **3055**

Recent Developments in Frequency Stabilization of Microwave Oscillators.—W. G. Tuller, W. C. Galloway & F. P. Zaffarano. (*Proc. Inst. Radio Engrs, W. & E.*, June 1948, Vol. 36, No. 6, pp. 794–800.) Pound's stabilizer (1690 of 1947 and 1311 of May) is discussed. The usable frequency range of the stabilizing circuit can be increased by changing the microwave circuit; this change is considered in detail and a graphical method of obtaining the frequency/voltage characteristic is explained. The amount of harmonic distortion in the output of the stabilizing circuit is calculated for the case where the microwave oscillator has f.m.

621.396.615.17 **3056**

Electrical Sawtooth Oscillations.—H. Hertwig. (*Funk u. Ton*, June 1948, Vol. 2, No. 6, pp. 300–307.) Discussion of the conditions governing the rise and fall for both linear and exponential waveforms, with formulae for rise and fall times, frequency, and mean value of the current.

621.396.619.16 **3057**

On some Characteristic Pulse Circuits.—J. Moline. (*Radio franç.*, May 1948, pp. 11–15.) Details of circuits for (*a*) low-power pulses, using phasing or dephasing, (*b*) frequency multipliers and dividers, and (*c*) high-power pulses suitable for the modulation of h.f. transmitters.

621.396.619.23 : 621.395.44 **3058**

Linear Theory of Bridge and Ring Modulator Circuits.—V. Belevitch. (*Elect. Commun.*, March 1948, Vol. 25, No. 1, pp. 62–73.) The question of impedance mismatch between filters and modulators, and the losses in CuO-rectifier type modulators, are considered with reference to single-sideband carrier telephone systems. With stated assumptions and approximations a simplified, practical theory is developed for bridge and ring modulators working between various ideal filter terminations. The transmission loss of a bridge modulator is measured experimentally under different terminating conditions approximating to those already assumed. Means of partially compensating for parasitic capacitance are described; these provide a basis for verifying the theory. An expression is given for the extra loss caused by the addition of capacitance to a capacitance-compensated modulator.

621.396.622.6 : 546.28 **3059**

The Silicon Crystal Detector.—(*Bell Lab. Rec.*, April 1948, Vol. 26, No. 4, pp. 152–155.) A short historical survey of development.

621.396.645 **3060**

The Use of Cathode Followers in the Penultimate Stage of Power Amplifiers.—S. E. Glikman. (*Vestnik Svyazi*, 1948, No. 6, pp. 9–11. In Russian.)

621.396.645 **3061**

A Low-Noise Amplifier.—H. Wallman, A. B. Macnee & C. P. Gadsden. (*Proc. Inst. Radio Engrs, W. & E.*, June 1948, Vol. 36, No. 6, pp. 700–708.) The 'cascode' amplifier consists of a grounded-cathode triode followed by a grounded-grid triode. The combination is noncritical and has the low noise factor of a triode with the amplification and stability of a pentode. Noise factors averaging 0.25 db at a carrier frequency of 6 Mc/s and 1.35 db at 30 Mc/s have been achieved. Typical circuit details are given. Summary noted in 2475 of September.

621.396.645 **3062**

Time Response of an Amplifier of *N* Identical Stages.—E. F. Grant. (*Proc. Inst. Radio Engrs, W. & E.*, July 1948, Vol. 36, No. 7, pp. 870–871.) The response to a unit-step voltage is calculated, assuming that the pass band is so narrow compared to the centre frequency that a low-pass equivalent circuit will describe the behaviour of the amplifier with sufficient accuracy.

621.396.645 **3063**

Amplifier Load Impedance Reduction.—B. M. Hadfield. (*Tele-Tech*, May 1948, Vol. 7, No. 5, Part 1, pp. 33–35..82.) Design equations for amplifiers to deliver power into low-value load impedances over a wide range of frequencies, without the use of high-ratio output transformers. A specific example is considered in detail.

621.396.645 : 518.3 **3064**

Exact Design and Analysis of Double- and Triple-Tuned Band-Pass Amplifiers.—M. Dishal. (*Elect. Commun.*, March 1948, Vol. 25, No. 1, pp. 100–102.) Reprint of discussion on 3065 of 1947 already noted in 1315 of May. Reprint of original paper noted in 2493 of September.

621.396.645 : 537.533.9 **3065**

Use of Photo-Conductive Semiconductors as Amplifiers.—E. S. Rittner. (*Phys. Rev.*, 15th May 1948, Vol. 73, No. 10, pp. 1212–1213.) The advantages of using a photoconductive semiconductor instead of an insulator as an amplifier are enumerated. Optimum results will probably be achieved with thin specimens of the same order of thickness as the penetration depth of the primary electron beam. Preliminary results for a polycrystalline layer of Se on glass are described. Further work on Se, Si, Ge and PbS is in progress. See also 2757 of October.

621.396.645 : 539.16.08 **3066**

A Battery-Fed Amplifier for Counter Tubes with Continuous Generation of the Counter-Tube Voltage from an Accumulator Battery.—A. Flammersfeld. (*Z. Naturf.*, March 1946, Vol. 1, No. 3, pp. 168–170.) From the counter impulses the amplifier produces current pulses of constant length. The circuit is an improvement on that described by Neher (1697 of 1939). In the h.v. generator the tetrode anode current of a tetrode-triode sawtooth-wave generator is used to feed the primary of an ordinary mains transformer, whose secondary gives a series of h.v. peaks.

621.396.645 : 621.396.822 **3067**

An Investigation of Amplifier Noise at Ultra High Frequencies.—V. I. Siforov. (*Radiotekhnika, Moscow*, May/June 1948, Vol. 3, No. 3, pp. 5–24. In Russian.) The theory of the one-stage amplifier is developed from consideration of an equivalent circuit consisting of a series of quadripoles in which an active noise-generating quadripole is included. Conditions for obtaining the maximum signal/noise ratio are established. The necessary and sufficient conditions for neutralizing valve noise are derived. The fundamental noise relationships in a multi-stage amplifier are determined; the noise factor of the amplifier can be deduced.

621.396.662(083.74) **3068**

Standardization of Tuning Units and Oscillators, 1948.—Radionyme. (*Toute la Radio*, June 1948, Vol. 15, No. 126, pp. 190–193.) A general discussion of the standards for 1939 and 1940 adopted by the Syndicat professionnel des Industries radioélectriques, with details of the standards proposed for 1948 by the S.N.I.R. (Syndicat national des Industries radioélectriques), which has taken the place of the S.P.I.R. The new standards include variable capacitors of 490 pF and 130 + 360 pF max. respectively, and 3- and 4-waveband tuning units for which suitable capacitance values are tabulated.

621.396.662.21 **3069**

Design Calculations for Short-Wave Band-Spread Coils.—J. Henry. (*Radio franç.*, May 1948, pp. 4–10.) Detailed calculations are made for tapped coils for the band 7–7.3 Mc/s; general formulae applicable to the whole of the s.w. bands are given. Tapped coils enable a single standard 460-pF capacitor to be used, and give a more linear spread than the series-capacitor method.

621.396.662.3 **3070**

An Experimental Investigation of the Wave-Guiding Properties of Multi-Terminal Filters.—V. V. Potemkin. (*Zh. tekh. Fiz.*, April 1948, Vol. 18, No. 4, pp. 447–454. In Russian.) Experiments were carried out with the ladder-type filters depicted in Figs. 1 and 2, to verify theoretical conclusions regarding various phenomena occurring in them, such as the appearance of different types of waves, dispersion of natural waves, band-pass filtering, and interruptions in the propagation of certain waves.

621.396.662.3 **3071**

Band Stoppers with Oscillating Crystals.—W. Herzog. (*Arch. elekt. Übertragung*, Jan. 1948, Vol. 2, No. 1 pp. 22–38.) Theory is given and design formulae are derived for both narrow- and broad-band stoppers. Suitable designs are given, with their functional characteristics, for (*a*) a broad-band stopper circuit using 2 crystals and 2 inductors, and (*b*) a narrow-band stopper using 3 crystals and 2 inductors.

621.396.662.3 : 621.396.611.21 **3072**

Quartz Filter Crystals with Low Inductance.—J. J. Vormer. (*Proc. Inst. Radio Engrs, W. & E.*, June 1948, Vol. 36, No. 6, pp. 802–804.) English version of 388 of February.

621.396.662.3 : 621.396.645 **3073**

A 3-Stage Coupling Filter for Wide-Band Amplifiers.—P. G. Violet. (*Funk u. Ton*, June 1948, Vol. 2, No. 6, pp. 290–299.) Theory, design formulae and practical details of a filter whose response curve shows three slight humps of equal height within the pass band, with relatively sharp cut-off at both limits.

621.396.665 **3074**

Adjustment Speed of Automatic-Volume-Control Systems.—A. W. Nolle. (*Proc. Inst. Radio Engrs, W. & E.*, July 1948, Vol. 36, No. 7, pp. 911–916.) The behaviour of an a.v.c. amplifier, following a sudden change of input level, is analysed on the basis of certain assumptions which are usually justified in practice. Equations are developed for the overload case and applied to a particular amplifier.

621.396.69 : 06.064 Paris **3075**

Components, 1948.—G. Giniaux. (*T.S.F. pour Tous*, March–May 1948, Vol. 24, Nos. 233–235, pp. 57–60, 92–96 & 142–143.) Discussion of the special features of the Paris exhibition. See also 1898 of July.

621.396.621.001.4 + 621.397.62.001.4 **3076**

Most-Often-Needed F.M. and Television Servicing Information. [Book Review]—M. N. Beitman. Supreme Publications, Chicago, 1948, 191 pp., $2.00. (*Proc. Inst. Radio Engrs, W. & E.*, July 1948, Vol. 36, No. 7, p. 884.)

GENERAL PHYSICS

53.081 + 621.3.081 **3077**

On Systems of Electrical Units.—É. Brylinski. (*Rev. gén. Élect.*, May 1948, Vol. 57, No. 5, pp. 200–204.) The use of the absolute systems of electrical units leads to certain difficulties, which are discussed. It is considered preferable to abandon the absolute systems and adopt e.s. and e.m. systems defined by the condition that the dielectric constant of a vacuum is the unit of dielectric constant, or that the permeability of a vacuum is the unit of magnetic permeability. These systems give the same numerical measures of electrical quantities as the absolute systems. See also 2504 of September (Dzung & Meldahl) and back references.

530.145 **3078**

On the Quantum Theory of Wave Fields.—F. J. Belinfante. (*Physica, 's Grav.*, Oct. 1940, Vol. 7, No. 8, pp. 765–778. In English, with German summary.)

535.215.6 : 621.383.5 **3079**

Theory of the Barrier-Layer Photoeffect.—K. Lehovec. (*Z. Naturf.*, May 1946, Vol. 1, No. 5, pp. 258–263.) Differential equations are established involving the relation between photocurrent and voltage, intensity of illumination, frequency of the light waves, the properties of the semiconductor and of the electrode, and the resistance of the external circuit. The properties of defect and excess semiconductors are discussed.

535.37 **3080**

Relation between Photoconduction and Luminescence in Zinc Sulphide.—M. H. F. Wilkins & G. F. J. Garlick. (*Nature, Lond.*, 10th April 1948, Vol. 161, No. 4093, pp. 565–566.)

537.213 : 517.1 : 532.58 **3081**

On the Harmonic and Biharmonic Problems of a Region Bounded by a Circle and two Parallel Lines.—R. Westberg. (*Ingen. Vetensk. Akad. Handl.*, 1948, No. 197, 66 pp. In English.) Analysis of the potential field of a circular cylinder between two parallel conducting planes, and also of the motion of a circular cylinder in a viscous fluid between two parallel planes.

537.228.1 **3082**

Equations of Piezoelectricity.—R. K. Cook. (*Nature, Lond.*, 3rd April 1948, Vol. 161, No. 4092, pp. 524–525.) In Cady's book on piezoelectricity (2084 of 1947), some confusion between generalized coordinates and forces in the Lagrange function results in erroneous piezoelectric equations. This gives rise to errors in the basically important linear equations which give the elastic stresses and electric field intensities as functions of the elastic strains and electric displacements.

537.228.1 + 539.3] : 512.9 **3083**

Applications of Tensor Analysis to Elasticity and Piezoelectricity.—J. H. Jurmain. (*J. Franklin Inst.*, June 1948, Vol. 245, No. 6, pp. 475–500.) A systematic theory of elasticity, based on tensor analysis, is developed and shown to give results consistent with those derived by other methods. The theory is extended to piezoelectricity and, if boundary conditions are carefully selected, the general solutions obtained are applicable to practical problems. Examples are given.

537.312.62 **3084**

On the Theory of Superconductivity.—F. J. Wiśniewski. (*C. R. Acad. Sci., Paris*, 14th June 1948, Vol. 226, No. 24, pp. 1964–1965.) A possible mechanism for superconductivity is described. The fundamental equation of London is deduced from the principles of mechanics.

537.52 **3085**

The Breakdown of Gases in High Frequency Electrical Fields.—D. H. Hale. (*Phys. Rev.*, 1st May 1948, Vol. 73, No. 9, pp. 1046–1052.) "It is assumed that breakdown occurs when the electrical field and the frequency are such that an electron acquires the ionizing energy at the end of one mean free path. The field for breakdown is thus a function of the frequency of the applied potential and the ionization potential and pressure of the gas. The fields for breakdown of argon and xenon are calculated and expressed as functions of the frequency and the gas pressure." Good agreement between calculated potentials and experimental results is found for frequencies $>$ 10 Mc/s.

537.523.5 **3086**

On the Theory of the High-Current Arc Column.—P. Schulz. (*Z. Naturf.*, Nov./Dec. 1947, Vol. 2a, Nos. 11/12, pp. 662–666.)

537.533.9 : 621.396.645 **3087**

Use of Photo-Conductive Semiconductors as Amplifiers.—Rittner. (*See* 3065.)

538.1 **3088**

On the Current and the Density of the Electric Charge, the Energy, the Linear Momentum and the Angular Momentum of Arbitrary Fields.—F. J. Belinfante. (*Physica, 's Grav.*, May 1940, Vol. 7, No. 5, pp. 449–474. In English, with German summary.)

538.213 : 538.221 **3089**

Determination of Magnetic Permeability from Resistance Measurements on Iron Wires of Different Structure at Frequencies of the order of 100 Mc/s, in relation to the Weiss Elementary Domains.—M. J. O. Strutt & K. S. Knol. (*Physica, 's Grav.*, July 1940, Vol. 7, No. 7, pp. 635–654. In German, with English summary.) The h.f. permeability calculated from the ratio of the a.c. and d.c. resistances is practically constant at room temperature up to about 300 Mc/s, but shows a marked decrease with increasing frequency at −183°C. An explanation of this is based on a simple model, which permits the determination of the order of magnitude of the Weiss domains for the different wires.

538.221 **3090**

Effect of Reversible and Irreversible Variations of Magnetization on the Thermoelectric Power of Ferromagnetic Materials.—J. Bouchard. (*C. R. Acad. Sci., Paris*, 7th June 1948, Vol. 226, No. 23, pp. 1895–1897.)

538.23 **3091**

On the Effective Length of a Small Barkhausen Discontinuity.—J. L. Snoek. (*Physica, 's Grav.*, July 1940, Vol. 7, No. 7, pp. 609–624. In English, with German summary.) The effective length is calculated for a wire of square cross-section and found to be equal to the product of the reversible permeability and the wire thickness.

538.242 **3092**

On the Theory of Gyromagnetic Effects.—C. J. Gorter & B. Kahn. (*Physica, 's Grav.*, Oct. 1940, Vol. 7, No. 8, pp. 753–764. In English, with French and German summaries.)

538.56 + 621.385.029.63/.64 + 621.384.6 **3093**

Waves and Electrons Traveling Together — A Comparison between Traveling Wave Tubes and Linear Accelerators.—L. Brillouin. (*Phys. Rev.*, 1st July 1948, Vol. 74, No. 1, pp. 90–92.) Travelling-wave valves operate with high space charge and weak waves of constant velocity, while 'synchro-' devices use very low space charge and high-power waves whose velocity is progressively increased. In one case there is an energy transfer from the electrons to the wave, which is strongly amplified; in the other case energy is transferred from the wave to the particles, which are thereby accelerated. A general theory is needed that would include both extreme cases of travelling-wave amplifiers and linear accelerators without introducing any restriction on the magnitudes of either fields or space charge. A composite wave is considered which has discontinuities in the derivative of the longitudinal field distribution and represents a sort of e.m. shock wave. It yields a rigorous solution of the wave equation for the case of space charge, and represents a generalization of the two extreme cases.

538.566 **3094**

Remarks on Spherical Electromagnetic Waves.—V. Sorokin. (*Zh. eksp. teor. Fiz.*, Feb. 1948, Vol. 18, No. 2, pp. 228–235. In Russian.) Using vectorial spherical functions, simple formulae are derived for spherical e.m. waves in vacuo and for e.m. fields of multipoles.

538.566 **3095**

A New Formula for Calculating the Phenomena of Diffraction.—É. Durand. (*C. R. Acad. Sci., Paris*, 31st May 1948, Vol. 226, No. 22, pp. 1812–1814.)

538.566 **3096**

Electromagnetic Theory of Diffraction by Black Screens.—É. Durand. (*C. R. Acad. Sci., Paris*, 14th June 1948, Vol. 226, No. 24, pp. 1972–1974.)

538.566 : 535.42 **3097**

Diffraction of Centimetre Electromagnetic Waves at an Aperture in a Metal Sheet.—H. Severin. (*Z. Naturf.*, Sept. 1946, Vol. 1, No. 9, pp. 487–495.) The Huyghens-Fresnel principle, formulated for radio waves, is applied to the accurate quantitative determination of diffraction effects along the normal through the centre of a circular aperture and also in the field near the aperture. Experiments with apertures of radius ranging from $\lambda/2$ to 8λ, and with wavelengths of 10 cm and 6 cm, confirm the theory, which is in agreement with Kirchhoff's diffraction theory and Maxwell's equations. See also 2326 of August (Tranter).

538.569.4 : 535.61-15 : 525.7 **3098**

Transmission of the Atmosphere in the 1-5 Micron Region.—A. Elliott & G. G. MacNeice. (*Nature, Lond.*, 3rd April 1948, Vol. 161, No. 4092, p. 516.) Details of equipment for measurements over a 600-yard path. A typical transmission curve shows high values between 3 μ and 4 μ, where transmission is comparable with that at 2.2 μ.

538.569.4 : 546.331.31-145.1 **3099**

Absorption of U.H.F. Waves in Salt Solutions.—S. K. Chatterjee & B. V. Sreekantan. (*Indian J. Phys.*, May 1948, Vol. 22, No. 5, pp. 229–242.) The absorption index is measured directly by a free-wave method at frequencies between 300 and 500 Mc/s for concentrations ranging from N/2 to N/16. Reflection coefficients at different frequencies are calculated ; the values of ionic relaxation time, dielectric constant, and loss angle obtained are compared with theoretical values deduced from the Debye-Falkenhagen theory. The product of the wavelength for maximum absorption and the concentration of the solution is approximately constant.

538.569.4.029.64 : 546.171.1 **3100**

Collision Broadening of the Ammonia Inversion Spectrum at High Pressures.—B. Bleaney & J. H. N. Loubser. (*Nature, Lond.*, 3rd April 1948, Vol. 161, No. 4092, pp. 522–523.) Measurements have been extended over the frequency range 0.1–1.2 cm^{-1} at pressures up to 6 atmospheres. See also 1916 of July and back references.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.53 : 621.396.96 **3101**

Velocity of Meteors Measured by Diffraction of Radio Waves from Trails during Formation.—C. D. Ellyett & J. G. Davies. (*Nature, Lond.*, 17th April 1948, Vol. 161, No. 4094, pp. 596–597.) The radiation scattered from the electron trail was observed as the meteor crossed the aerial beam ; the variation in received power is compared with Fresnel's integrals for diffraction at a straight edge. The mean geocentric velocity deduced for the Geminid meteors is 34.4 km/s, in good agreement with Whipple's value of 34.7 km/s obtained from photographic measurements of visible meteors.

523.72 + 523.16] : 621.396.822 **3102**

Radio Noise of Extra-Terrestrial Origin and its Effect on Telecommunication Technique.—G. Lehmann. (*Onde élect.*, April & May 1948, Vol. 28, Nos. 253 & 254, pp. 164–172 & 200–205.) The present state of knowledge of cosmic noise is reviewed, reference being made to investigations on wavelengths ranging from decametres to millimetres. The fundamental principles of thermodynamics necessary for the interpretation of the experimental results are recalled, receiver noise factor is defined and a method of measuring it is described. The performance of actual u.h.f. receivers is compared with that which is theoretically possible.

523.72.029.63 : 523.746 **3103**

A Solar Noise Outburst at 600 Mc/s and 1 200 Mc/s.—F. J. Lehany & D. E. Yabsley. (*Nature, Lond.*, 24th April 1948, Vol. 161, No. 4095, pp. 645–646.) Bursts similar to those at 200 Mc/s described in 412 of February (McCready, Pawsey & Payne-Scott) are not normally observed at 600 and 1 200 Mc/s ; noise level rises gradually as the sunspots appear, and shows correlation with sunspot area. On one occasion only, large bursts occurred at 600 and 1 200 Mc/s, but not at 200 Mc/s.

523.746 **3104**

Magneto-Hydrodynamic Waves and Sunspots : Part 3.—H. Alfvén. (*Ark. Mat. Astr. Fys.*, 13th April 1948, Vol. 34, Part 4, Section A, No. 23, 20 pp. In English.) The instability factor θ_z is zero at the centre of the sun, rises to a maximum as distance from the centre is increased radially, and thereafter falls again to zero at the surface of the unstable core.

A disturbance in the zone of maximum instability in, say, the northern hemisphere gives rise to two hydrodynamic waves travelling in opposite directions parallel to the magnetic field. One wave escapes into the stable zone and on reaching the surface of the sun gives rise to a spot. The other passes through the unstable core and is subject to an acceleration, which is a function of θ_z, and is negligible until the southern zone of maximum instability is reached. Any acceleration of the wave results in a new disturbance and a new pair of waves having amplitudes proportional to the acceleration. Thus there are two strong waves emitted from this southern zone ; one forms a spot in the southern hemisphere of the sun and the other retraces the path through the core. The process is repeated until it is attenuated to negligible proportions. We should thus expect a harmonic process of period T, the time taken for the wave to cross the core. T can be shown to be about 11 years.

The theory would also predict a correlation between sunspot activity at a given latitude in one hemisphere at a given epoch of one cycle and that at the same latitude in the other hemisphere in adjacent cycles. Statistical analysis, noted in 3105 below, confirms this hypothesis. For previous parts see *Mon. Not. R. astr. Soc.*, 1945, Vol. 105, Nos. 1 & 6, pp. 3–16 & 382–394; abstracts of these will appear shortly. See also 2231 of August (Cowling) and back references.

523.746 : 519.251.8 **3105**

Statistical Tests of H. Alfvén's Theory of Sunspots.—I. Galvenius & H. Wold. (*Ark. Mat. Astr. Fys.*, 13th April 1948, Vol. 34, Part 4, Section A, No. 24, 9 pp. In English.) See 3104 above.

523.746 : 621.396.11 **3106**

Sunspots and Radio Weather.—A. Arzinger, H. E. Hallborg & J. H. Nelson. (*RCA Rev.*, June 1948, Vol. 9, No. 2, pp. 229–244.) The sunspots producing disturbance in h.f. radio communication are found to lie mainly within a semicircle of about 26° radius in the eastern half of the solar disk ; its centre coincides with that of the disk. The spots have maximum effect when they cross either the circle or the central meridian. While they are within the semicircle they cause erratic conditions. Studies of the polarities of the spots show that, for the northern hemisphere, 'reds' (positive) have a preponderant effect and tend to lower frequencies, while 'violets' (negative) tend to raise them. The reverse is true for the southern hemisphere. These observations, in combination with Washington F-layer data, are applied to short-period radio-weather forecasting.

523.752 **3107**

A Chromospheric Eruption of Extraordinary Size.—A. Behr. (*Z. Naturf.*, Sept. 1946, Vol. 1, No. 9, pp. 537–539.) An account, with photographs, of a very large eruption observed at the Fraunhofer Institute on 25th July 1946, and of simultaneous recording of the field strength of a London 9.66-Mc/s transmission. The field strength fell to a low value at the commencement and remained low for the duration of the eruption. About 26½ hours after the start of the eruption a geomagnetic storm was recorded at the Hamburg-Wingst observatory ; this time lag corresponds to a velocity of the particle radiation from the sun of 1 570 km/s. An aurora of medium brightness was observed for about an hour at Freiburg some 6 hours after the start of the magnetic storm. This was also seen in Paris and in Switzerland.

538.12 : 521.15 **3108**

Blackett's Hypothesis of the Magnetic Field of Rotating Bodies.—N. Arley : J. Fuchs. (*Nature, Lond.*, 17th April 1948, Vol. 161, No. 4094, pp. 598–599.) Comment on 3112 of 1947 (Blackett). Difficulties involved in Blackett's interpretation are discussed by Arley and possible experimental tests suggested, such as those of Barnett on gyromagnetic magnetization, and of Einstein & de Haas on the inverse effect of rotation by magnetization.

Fuchs interprets Blackett's constant of proportionality by expressing it in a dimensionless form valid for the non-rational e.m. system of units as well as the usual non-rational e.s. system.

550.384 : 551.510.5 : 525.624 **3109**

A Possible Influence of the Moon on Recurrent Geomagnetic Activity.—O. R. Wulf & S. B. Nicholson. (*Phys. Rev.*, 15th May 1948, Vol. 73, No. 10, pp. 1204–1205.) Tidal air mounds due to the moon may be one of the factors which account for the observed 27-day period of geomagnetic activity. See also 3900 of 1947.

550.384 : 551.510.535 : 523.7 **3110**

Evidence of a Solar Effect on the Ionized Regions of the Upper Atmosphere.—P. Lejay, A. Haubert & J. Durand. (*C. R. Acad. Sci., Paris*, 31st May 1948, Vol. 226, No. 22, pp. 1768–1770.) Comparison of continuous records of F_2-layer critical frequency variations and magnetic *K*-indices for September 1946, reveals a definite correlation between the two. The variations corresponding to magnetic storms have, in general, the same sense at stations as far apart as Slough, England, and Washington, D.C. The fact that the observed variations are generally greatest in the middle of the day, when the sun is high, suggests a quasi-instantaneous action of the sun.

550.384.3 **3111**

Basis and Preparation of the Magnetic Deviation Chart for the Epoch 1945.0.—F. Burmeister. (*Beitr. Geophys.*, 1944, Vol. 60, Nos. 3/4, pp. 177–195.) Discussion of all the data, from various sources, on which the chart was based.

550.384.3 **3112**

A Contribution to the Knowledge of Magnetic Secular Variation.—A. Kiskyras. (*Beitr. Geophys.*, 1944, Vol. 60, Nos. 3/4, pp. 222–234.) Discussion based on the theory that the greater part of the secular variation is due to changes in the magnetization of the rocks in the upper 20 km of the earth's crust. Such changes are brought about by changes of temperature.

550.385 "1941.03.01" : 537.591 **3113**

Contribution to Material on the Effect of the Magnetic Storm of 1st March 1941 on Cosmic Radiation.—A. Sittkus. (*Z. Naturf.*, April 1946, Vol. 1, No. 4, pp. 264–208.) The results published by Kölhorster (12 of 1945) were obtained at Dahlem and Graz by coincidence methods. Ionization-chamber measurements at Freiburg i. Br. are here described and an estimate is made of the temperature effect at all three stations. The effect of the magnetic storm was qualitatively similar for the three places, though the amplitudes of the fluctuations differed.

551.510.53 (479) **3114**

The Structure of the Upper Layers of the Atmosphere as determined by Twilight Observations.—T. G. Megrelishvili & I. A. Khvustikov. (*C. R. Acad. Sci. U.R.S.S.*, 1st March 1948, Vol. 59, No. 7, pp. 1283–1286. In Russian.) Values of upper-air density and pressure deduced from spectrophotometric observations have been obtained regularly since 1942 at Abbastuman observatory (South-West Caucasus) during morning and evening twilight. Results agree closely with those of other workers using different methods.

551.510.535 **3115**

An Approach to the Approximate Solution of the Ionosphere Absorption Problems.—J. E. Hacke, Jr. (*Proc. Inst. Radio Engrs, W. & E.*, June 1948, Vol. 36, No. 6, pp. 724–727.) A series of parabolic approximations has been obtained for portions of the Chapman distribution and its product with the collisional frequency. By their use, an improved approximate solution has been found for the 'true' and the group height of reflection, and for the absorption in the region, under conditions of (*a*) vertical incidence, (*b*) wave frequency greater than the maximum collision frequency and less than the critical frequency for the region, and (*c*) with the earth's magnetic field neglected.

"These improved analytic approximations are compared with the usual parabolic approximation and with numerical approximations obtained by other workers."

551.510.535 **3116**

Electrical Conductivity of the Ionospheric D-Layer.—T. G. Cowling & R. Borger. (*Nature, Lond.*, 3rd April 1948, Vol. 161, No. 4092, p. 515.) Martyn's suggestion (1024 of April), that electric currents in the D layer must make a contribution to the solar and lunar geomagnetic variations roughly equal to that of the E and F layers, implies that the integral conductivity of the D layer must be as great as that of the E and F layers combined. Discussion shows this to be improbable.

551.510.535 : 621.396.11 **3117**

Upper-Atmosphere Circulation as Indicated by Drifting and Dissipation of Intense Sporadic-E Clouds.—O. P. Ferrell. (*Proc. Inst. Radio Engrs, W. & E.*, July 1948, Vol. 36, No. 7, pp. 879–880.) The motion of such clouds is illustrated by a series of maps for two recent occasions when the clouds were sufficiently intense to permit long-range communication in the 50–54-Mc/s amateur band.

551.510.535 : 621.396.11 **3118**

Triple Splitting of Ionospheric Rays.—Eckersley. (*See* 3222.)

551.510.535 : 621.396.11 **3119**

Triple Splitting of Ionospheric Rays.—Meek. (*See* 3221.)

551.513 **3120**

Intensity of the Zonal Circulation in the Atmosphere outside the Tropics.—H. Flohn. (*Beitr. Geophys.*, 1944, Vol. 60, Nos. 3/4, pp. 196–209.) From new circumpolar charts of the atmospheric temperature and pressure distributions in the northern hemisphere, new mean values of the zonal component of the currents at heights of 5, 11, 16 and 22 km in temperate latitudes are deduced. Marked differences are found between the continental and maritime sectors.

551.578.1 : 621.396.96 **3121**

Measurement of Rainfall by Radar.—J. S. Marshall, R. C. Langille & W. McK. Palmer. (*J. Met.*, Dec. 1947, Vol. 4, No. 6, pp. 186–192. Reprint.) Experiments using 10-cm radar equipment have confirmed theoretical conclusions that the radiation reflected from rain is proportional to Z, the sum of the sixth powers of diameters of raindrops in a representative volume. Correlation of Z with rainfall intensity R at ground level suggests that $Z \propto R^2$, approximately. It may be possible to determine rainfall intensity 100 km away by radar echo, since vertical scanning indicates that rain content varies only slightly with height. See also 2062 of July (Ryde) and back reference.

LOCATION AND AIDS TO NAVIGATION

621.396.93 : 551.594.6 **3122**

Distant Localization of Individual Atmospherics with a Cathode-Ray Direction-Finder of Unidirectional Type.—W. Stoffregen. (*Ark. Mat. Astr. Fys.*, 13th April 1948, Vol. 34, Part 4, Section A, No. 26, 14 pp. In English.) An improved form of c.r. direction finder is described in which a 'sense aerial' eliminates an uncertainty of 180° by blacking out the negative half-cycle. Radar technique is used to determine the range.

621.396.933 **3123**

C.A.A. V.H.F. Omnidirectional Range at United Air Lines.—F. J. Todd. (*Communications*, April 1948, Vol. 28, No. 4, pp. 10–11, 34.) The new system referred to as VOR (v.h.f. omnidirectional range) has the advantages of improved accuracy of indication, comparatively static-free operation, greater flexibility, and channel assignments adequate to accommodate the needs of expanding air traffic. The system provides the information necessary to enable an aircraft to fly along a definite path with respect to the VOR station. The component parts of the equipment are described.

621.396.96 **3124**

Frequency-Modulated Radar Techniques.—I. Wolff & D. G. C. Luck. (*RCA Rev.*, June 1948, Vol. 9, No. 2, pp. 352–362.) Continuation of 2798 of October. Two superheterodyne systems, namely a sideband system and a signal-following system, remove the transmitted modulation from the received i.f. signal. An electromechanical device using a vibrating capacitor and an electronic device using a beam of electrons have proved useful for f.m. of radar oscillators. Several adaptations of the well-known cycle-rate counter for making use of beat-frequency data have made f.m. radar very useful where automatic indication of, or control by, the range and speed of a single target is needed. To be continued.

621.396.96 **3125**

Technique and Development of Radar.—Demanche. (*Onde élect.*, May 1948, Vol. 28, No. 254, pp. 206–210.) Discussion of methods of eliminating permanent echoes. See also 1366 of May.

MATERIALS AND SUBSIDIARY TECHNIQUES

533.5 **3126**

On the Theory of the Diffusion Pump.—R. Jaeckel. (*Z. Naturf.*, Nov./Dec. 1947, Vol. 2a, Nos. 11/12, pp. 666–667.) The physical processes in the diffusion pump are treated theoretically and first- and second-approximation formulae for quantitative calculation are derived. From these formulae the power of a diffusion pump or the design characteristics for a pump of given power can be determined.

535.37 **3127**

The Effect of Electron Distribution at Localized Levels on the Course of Different Luminescence Processes in the CaS.SrS-Ce,Sm,La Phosphors and the Number of Repeated Electron Localizations.—V. L. Levshin. (*Zh. eksp. teor. Fiz.*, Feb. 1948, Vol. 18, No. 2, pp. 149–163. In Russian.) An experimental investigation which shows that the luminescence processes depend not only on the number of ionized centres and localized electrons but also on the electron distribution at localized levels. It is shown that the number of repeated localizations of electrons is not great. Repeated flashes and phosphorescence are examined in detail.

535.37 **3128**

The Nature of Centres of Luminescence in Photochemically-Coloured Alkali-Halide Crystals.—M. L. Katz. (*Zh. eksp. teor. Fiz.*, Feb. 1948, Vol. 18, No. 2, pp. 164–173. In Russian.)

535.37 **3129**

On a Group of Mixed Phosphors with Mixed Activators.—P. Brauer. (*Z. Naturf.*, Feb. 1946, Vol. 1, No. 2, pp. 70–78.) An investigation of the properties of mixed sulphides of the alkaline earths with Sm as one activator and either Ce, Pr, Eu, Mn or Pb as the other. The behaviour of SrS.Eu-Sm differs considerably from that of other members of the group, whose general properties can be explained on the assumption that Sm acts as a 'killer' substance. See also 762 of 1940.

535.37 : 535.61-31 **3130**

Miscellaneous Observations on the Rise and Decay of the Luminescence of Various Phosphors.—W. de Groot. (*Physica, 's Grav.*, May 1940, Vol. 7, No. 5, pp. 432–446. In English, with French and German summaries.) Results are given for periodic illumination of the following substances by intense ultra-violet light: ZnS-Ag, ZnS-Cu, ZnSCdS-Ag, ZnSMnS, $CaWO_4$-Sm, and Zn_2SiO_4-Mn.

535.37 : 621.385.832 **3131**

Fluorescent Compounds.—(*Electronics, Buyers' Guide Issue*, June 1948, Vol. 21, No. 6A, p. M17.) Colours, luminous efficiencies and other characteristics are tabulated for various materials used for c.r. tube screens.

535.61-15 : 621.383.4 **3132**

Spectral Sensitivity of Lead Telluride Layers.—T. S. Moss. (*Nature, Lond.*, 15th May 1948, Vol. 161, No. 4098, pp. 766–767.) Curves of relative sensitivity and wavelength are shown for temperatures of 195°K, 90°K and 20°K; the results differ considerably from those obtained by earlier workers. The threshold of sensitivity at 90°K is similar to that for PbSe but the PbTe layers are easier to produce and form efficient infra-red detectors for wavelengths up to 5 or 6 μ at 20°K.

537.228.1 + 621.314.63 **3133**

Crystal.—(*Electronics, Buyers' Guide Issue*, June 1948, Vol. 21, No. 6A, pp. M14–M16.) Electrical characteristics of quartz, EDT and DKT crystals, and of Si, Se and CuO rectifiers are tabulated or shown graphically.

537.228.1 **3134**

Compressional Piezoelectric Coefficients of Monoclinic Crystals.—H. Jaffe. (*Phys. Rev.*, 15th June 1948, Vol. 73, No. 12, p. 1467.) Experimental values are given for the coefficients relating to fields parallel to the polar axis. The hydrostatic piezoelectric effect for EDT appears to be much smaller than that derived from Mason's data (740 of March).

537.312.62 **3135**

Measurements of Radio Frequency Resistance of a Piece of Columbium Nitride through the Transition [from the normal to the superconducting state].—J. V. Lebacqz. (*Phys. Rev.*, 15th June 1948, Vol. 73, No. 12, p. 1476.) The measured values for frequencies between 600 and 1 000 kc/s were the same as the d.c. values at the same temperatures.

538.221 : 538.213 **3136**

On the Dispersion of Initial Permeability.—J. L. Snoek. (*Physica, 's Grav.*, June 1940, Vol. 7, No. 6, pp. 515–518. In German, with English summary.) Purified and annealed Fe has an initial permeability, at frequencies of the order of 1 c/s, which is many times higher than the value determined from measurements of the skin effect at frequencies of 1–100 Mc/s. Present theories offer no explanation of this.

538.27 **3137**

The Effect of Premagnetization on the Complex Permeability of Coil Cores.—R. Feldtkeller & E. Stegmaier. (*Frequenz*, May 1948, Vol. 2, No. 5, pp. 121–130.) The laws connecting premagnetization with the complex permeability of Si–Fe and Ni–Fe sheet are reviewed, with particular reference to curves relating the critical value of the complex permeability to the frequency and amplitude of the a.c. induction. With constant a.c. induction, premagnetization has an effect on the eddy currents in the material. This effect is explained by the action of the premagnetization on the reversible permeability of the surface layers and of the interior of the sheet.

546.42/.431].82 **3138**

Barium Titanate and Barium Strontium Titanate Resonators.—H. L. Donley. (*RCA Rev.*, June 1948, Vol. 9, No. 2, pp. 218–228.) Values of the equivalent circuit elements are given for such resonators vibrating normal to the direction of the polarizing and r.f. fields. An increase in the effective piezoelectric constant with increasing polarizing field is observed. At 25 V/mil an average piezoelectric constant of about 200×10^{-8} e.s. units, a Q of 80 and an electromechanical coupling factor of 0.2 are found for $BaTiO_3$ resonators. Lower activity, but higher Q, results with $(Ba/Sr)TiO_3$ resonators. A frequency constant of 211 kc/s-cm is found for $BaTiO_3$ resonators ; for mixtures this rises to 275 kc/s-cm as the Sr content increases to 30%. The piezoelectric activity ceases as the Curie temperature of a particular composition is approached. A large temperature coefficient of frequency of 1 part in 400 per 1°C limits the use of $BaTiO_3$ for resonators, but it compares favourably with Rochelle salt for use in pickups.

546.431.82 : 537.228.1/.2 **3139**

Piezoelectric or Electrostrictive Effect in Barium Titanate Ceramics.—W. P. Mason. (*Phys. Rev.*, 1st June 1948, Vol. 73, No. 11, pp. 1398–1399.) Resonance effects in multicrystalline $BaTiO_3$ ceramics are shown to be electrostrictive ; they are analogous to magnetostrictive effects in ferromagnetic materials, and not to the 'quadratic' piezoelectric effect discussed by Mueller (2186 of 1940).

549.623.5(94) : 621.315.613 **3140**

Australian Mica.—(*Engineering, Lond.*, 16th April 1948, Vol. 165, No. 4290, p. 379.) The output of high-grade mica could be increased to 250 tons/year, equivalent to 15% of world production, by provision of improved equipment and amenities for workers.

621.3.015.5 : 546.217 **3141**

Electrical Breakdown Strength of Air at Ultra High-Frequencies.—J. A. Pim. (*Nature, Lond.*, 1st May 1948, Vol. 161, No. 4096, pp. 683–684.) A series of experiments in the frequency range 100–300 Mc/s, using c.w. throughout and an improved method of measuring the r.f. voltage at the point of breakdown. The relations obtained between the electrical breakdown stress and gap width, frequency and gas pressure suggest that with an alternating field of a particular frequency, some charged particles, probably electrons, are unable to cross the gap before the field is reversed.

621.315.612 + 666 **3142**

Ceramics and Glass.—(*Electronics, Buyers' Guide Issue*, June 1948, Vol. 21, No. 6A, pp. M4–M5.) Electrical, thermal and mechanical properties are tabulated for various materials, with brief remarks about each.

621.315.615 **3143**

A Brief Outline of Insulating Oil Problems.—E. S. Lane. (*Distrib. Elect.*, April 1948, Vol. 20, No. 170, pp. 337–338.) Summary of paper read at an Australian Electricity Supply Engineers' Association conference. The presence of oxygen causes acidity and sludging. Oxidation can be reduced by using inert gases, silica-gel, or conservators.

621.315.616 : 533.5 **3144**

Vacuum Properties of Synthetic Dielectrics.—B. G. Hogg & H. E. Duckworth. (*Rev. sci. Instrum.*, May 1948, Vol. 19, No. 5, pp. 331–332.) Wide differences of vapour pressure are found in vacuum tests on 28 commercial materials. Many of these, such as polystyrene, teflon and mycalex, are particularly suitable for use in vacuum systems.

621.315.616 : 678 **3145**

Rubber Dielectrics — Some Chemical Aspects.—B. B. Evans. (*Distrib. Elect.*, July 1948, Vol. 21, No. 171, pp. 2–6.) Qualitative accelerated aging tests for the study of rubber dielectric deterioration are described. Vulcanizing processes are hastened by the use of organic accelerators, the desirable properties of which are discussed. Life can be increased by incorporating small amounts of 'anti-oxygen' or 'disactivator' materials.

621.318.22 + 621.318.32 **3146**

Magnetic Materials.—(*Electronics, Buyers' Guide Issue*, June 1948, Vol. 21, No. 6A, pp. M20–M23.) Characteristics are tabulated for materials used for laminated, solid and powdered metal cores and for permanent magnets.

621.383 **3147**

On the Absorption, Light Sensitivity and Electrical Conductivity of CdS Layers.—K. Weiss. (*Z. Naturf.*, Nov./Dec. 1947, Vol. 2a, Nos. 11/12, pp. 650–652.) A short review of the properties of layers produced by a particular process. The sensitivity is 10^{-2} A/lumen and a light power of 10^{-10} W can be detected. Completely insulating layers of CdS, PbS and Sb_2S_3 have been produced.

621.383 : 546.817.221 **3148**

On the Effect of Gases, particularly of Traces of Oxygen, on the Electrical Properties of Evaporated PbS Layers.—H. Hintenberger. (*Z. Naturf.*, Jan. 1946, Vol. 1, No. 1, pp. 13–17.) An investigation of the effect of N, Ar, O, H and air. N and Ar have no effect, but air and especially small traces of O have a marked effect, which is qualitatively the same as that of a sulphur treatment. Tempering in H increases the conductivity of PbS layers with excess Pb.

621.395.625.3 **3149**

Test Characteristics of Recording Wire.—G. S. Carter & R. Koontz. (*Tele-Tech*, May 1948, Vol. 7, No. 5, Part 1, pp. 38–40..75.)

669 **3150**

Metals and Alloys.—(*Electronics, Buyers' Guide Issue*, June 1948, Vol. 21, No. 6A, pp. M24–M29.) Brief details of various compositions used for solders, resistors, switches and contacts, thermocouples, and valve parts.

678.72 **3151**

New Synthetic Rubber has High Oil and Heat Resistance.—(*Materials & Methods*, June 1948, Vol. 27, No. 6, pp. 72–74.) Discussion of a polyacrylic ester, commercially named Hycar P.A., which withstands dry heat to 400°F, has excellent resistance to deterioration by oils or sunlight, forms a good gas barrier and has a good flex life. Methods of preparing cured varieties of varying hardness are described. The relative merits of Hycar P.A., Lactoprene EV and styrene rubber GR-S are discussed.

679.5 **3152**

Plastics.—(*Electronics, Buyers' Guide Issue*, June 1948, Vol. 21, No. 6A, pp. M30–M35.) Electrical and mechanical properties of moulding and casting compounds, laminated materials, and synthetic and natural rubbers.

679.5 : 620.193 **3153**

The Effect of Fungi and Humidity on Plastics.—J. Leutritz, Jr. (*ASTM Bull.*, May 1948, No. 152, pp. 88–90.) Discussion of experimental results for various materials exposed to tropical conditions. Fungus without moisture is a fairly good insulator. Elimination or mitigation of moisture difficulties will automatically control fungus and reduce insulation failures.

679.5 : 621.397.5 : 535.88 **3154**

Plastic Lenses in Television Projection.—D. Starkie. (*J. Televis. Soc.*, Sept. 1947, Vol. 5, No. 3, pp. 86–92. Discussion, p. 93.) The properties of suitable plastic optical materials are discussed, and a method of manufacturing lenses by a 'surface-finishing' process is described. A preform plastic optical component is first moulded, using light polymerization. The preform is removed from the mould and annealed. Any departures from the form of the mould found after the annealing are corrected by casting a thin film of polymer on the surface of the preform.

679.5 : 621.793 **3155**

Metal-Coated Plastics combine Advantages of Both Materials.—H. R. Clauser. (*Materials & Methods*, June 1948, Vol. 27, No. 6, pp. 79–82.) Metal coatings can be applied by electro-plating, vacuum evaporation or metal spraying. The relative merits of these methods are discussed, and various practical applications are mentioned. See also 2544 of September (Narcus).

679.5 : 681.42 **3156**

Plastics as Optical Materials.—H. R. Moulton. (*ASTM Bull.*, March 1948, No. 151, pp. 75–77. Discussion, p. 77.) Discussion of: (*a*) properties of optical materials, (*b*) the relative merits of glass and plastics, (*c*) methods of processing plastics, (*d*) future possibilities of using complex mixtures.

533.5 **3157**

A Manual of Vacuum Practice. [Book Review]—L. H. Martin & R. D. Hill. Melbourne University Press, Melbourne; Oxford University Press, London; 1947, 120 pp., 10s. 6d. (*Nature, Lond.*, 1st May 1948, Vol. 161, No. 4096, p. 665.) "An excellent addition to the all too few modern books in the English language on vacuum technique . . . the commercial apparatus referred to in the text includes both English and American types of the most modern pattern."

MATHEMATICS

517.392 : 621.396.67 **3158**

Concerning a New Transcendent, its Tabulation and Application in Antenna Theory.—C. J. Bouwkamp. (*Quart. appl. Math.*, Jan. 1948, Vol. 5, No. 4, pp. 394–402.) Some of the features of the function

$$E_1(z) = \int_0^1 \int_0^1 (1 - e^{-jzst})\, ds\, dt/st$$

are discussed with particular reference to Hallén's aerial theory. A short table of numerical values is given.

517.512.2 : 621.396.67 **3159**

Fourier Transforms in Aerial Theory: Part 6.—J. F. Ramsay. (*Marconi Rev.*, April/June 1948, Vol. 11, No. 89, pp. 45–50.) Conclusion of 2270 of August. The earlier parts are summarized and further developments indicated. A classified bibliography of 82 references is included.

518.5 **3160**

The Univac.—(*Electronic Industr.*, May 1948, Vol. 2, No. 5, pp. 9, 19.) Summary of I.R.E. 1948 Convention paper noted in 2548 of September. A short description of a high-speed electronic digital computer. The method of storing 1 000 12-digit numbers as supersonic pulses in Hg columns is described. Magnetic tape recording is used to pass controlling instructions and data to and from the computer. Possible applications varying from the solution of integral and partial differential equations to the classification of statistical information are discussed.

518.5 **3161**

Compact Analog Computer.—S. Frost. (*Electronics*, July 1948, Vol. 21, No. 7, pp. 116–122.) A technical description of the Reeves Electronic Analog Computer (REAC) together with circuit diagrams and photographs. The REAC comprises a computer unit, servomechanism unit, recorder unit, and associated power supplies. Solutions of both linear and nonlinear simultaneous differential equations, such as occur in design engineering, can be readily obtained.

518.61 : 621.396.611.1 **3162**

The Escalator Process for the Solution of Damped Lagrangian Frequency Equations.—J. Morris. (*Phil. Mag.*, April 1947, Vol. 38, No. 279, pp. 275–287.) Extension of 1636 of 1945 (Morris & Head) to equations of the Lagrangian type in which each element is a polynomial instead of merely a linear function of the unknown latent root. The 'modes' of such equations have orthogonal properties analogous to those for ordinary Lagrangian frequency equations. See also 2167 of 1947.

518.61 : 621.396.611.1 : 512.831 **3163**

Note on the Morris Escalator Process for the Solution of Linear Simultaneous Equations.—R. A. Frazer. (*Phil. Mag.*, April 1947, Vol. 38, No. 279, pp. 287–289.) The process described in 463 of 1947 (Morris) is here expressed in matrix form. See also 3162 above.

519.27 : 530.16 **3164**

Distribution of the Sum of Randomly Phased Components.—W. R. Bennett. (*Quart. appl. Math.*, Jan. 1948, Vol. 5, No. 4, pp. 385–393.) A method of finding the distribution of the sum of n vectors with given moduli and randomly distributed arguments for values of n of the order of 10. A convergent Fourier-Bessel series is derived. The special case where all the vectors have equal moduli is used to illustrate the method, which is later extended to the general case. The envelope of a group of sine waves is briefly discussed.

MEASUREMENTS AND TEST GEAR

531.761 **3165**

A Portable Electronic Chronometer.—G. T. Baker. (*J. sci. Instrum.*, June 1948, Vol. 25, No. 6, pp. 194–198.) A crystal-controlled chronometer, which measures intervals up to 1 sec with an accuracy of 0.1 ms and can be used by a semi-skilled operator for measuring circuit transients, operation times of relays, etc.

621.3.018.4 (083.74) **3166**

Two Portable Substandards of Frequency.—R. Terlecki & J. W. Whitehead. (*J. sci. Instrum.*, July 1948, Vol. 25, No. 7, pp. 237–239.) Details of two instruments, using crystal-controlled multivibrators, which give spot frequencies (*a*) 10 kc/s, (*b*) 1 kc/s apart over the range 10 kc/s–35 Mc/s. Check points are available at intervals of 1 Mc/s and 5 Mc/s and in the second instrument the output may be modulated.

621.3.018.4(083.74) **3167**

Portable Crystal-Controlled Frequency Standard.—R. I. B. Cooper. (*Elect. Commun.*, March 1948, Vol. 25, No. 1, pp. 30–34.) Illustrations and performance details of a sub-standard using a 100-kc/s GT-cut crystal with plated electrodes, mounted in an evacuated bulb.

621.317.3 : 621.392.029.64 **3168**

On the Representation and Measurement of Waveguide Discontinuities.—Marcuvitz. (*See* 3020.)

621.317.3.011.5 **3169**

The Plate Method for Determining Dielectric Constants and Loss Angles.—I. A. El'tsin. (*Zh. tekh. Fiz.*, May 1948, Vol. 18, No. 5, pp. 657–664. In Russian.) A rigorous theory is given of a method in which a thin plate of the material under investigation is placed at the middle of a tuned Lecher system. Formulae are derived for calculating, from measurements at λ 3.36 m, the dielectric constants and loss angles for various solid dielectrics.

621.317.336 **3170**

Accuracy of Impedance Measurements.—B. Secker. (*Elect. Commun.*, March 1948, Vol. 25, No. 1, pp. 74–83.) Impedance-unbalance and precise impedance measurement systems are considered. Sources of errors in bridges of various types are discussed and comparisons made between different bridges for particular measurements. Curves show the limits of measurement of series- and parallel-resonance bridges ; the fundamental balance conditions for different types of bridge are derived.

621.317.35 **3171**

A New Method in the Analysis of Complex Electric Waves.—W. E. Rogers. (*Rev. sci. Instrum.*, May 1948, Vol. 19, No. 5, pp. 332–335.) A potentiometer method for direct measurement of the phase and amplitude of the harmonic components of complex waves. A known complex waveform having a periodic relationship with the wave to be analysed is used as a reference and both waves are fed to a tunable, frequency-selective detector which acts as a null indicator. Comparison is made by adjusting the amplitude and phase of the reference wave.

621.317.44 : 538.632 : 546.289 **3172**

A Magnetic Field Strength Meter Employing the Hall Effect in Germanium.—G. L. Pearson. (*Rev. sci. Instrum.*, April 1948, Vol. 19, No. 4, pp. 263–265.) The essential components include a small Ge probe and a microammeter which is calibrated directly in gauss. Accuracy is within 2% for fields between 100 and 8 000 gauss. At higher field strengths the readings are too low, the error being about 9% at 20 000 gauss. Advantages are (*a*) small size and portability, (*b*) steady reading, (*c*) small nonmagnetic probe which can be used in very narrow gaps.

621.317.7 **3173**

New Long-Scale Instruments.—R. M. Rowell & N. P. Millar. (*Gen. elect. Rev.*, April 1948, Vol. 51, No. 4, pp. 14–19.) Construction details of d.c. and a.c. ammeters and voltmeters, wattmeters, power-factor meters and frequency meters with pointer movement of 250°.

621.317.715 **3174**

The Construction of Micro-Galvanometer Systems.—A. C. Downing. (*J. sci. Instrum.*, July 1948, Vol. 25, No. 7, pp. 230–231.) Systems of period 0.01 sec, resistance 20 Ω, 0.3–0.5 mm wide and weighing 3–5 mg are described, with methods of winding and inserting connecting tags. See also 3175 below.

621.317.715 **3175**

Moving-Coil Galvanometers of Short Period and their Amplification.—A. V. Hill. (*J. sci. Instrum.*, July 1948, Vol. 25, No. 7, pp. 225–229.) The design and performance of a short-period galvanometer and photoelectric amplifier are discussed. Potential changes of a few microvolts in a low-resistance circuit can be measured to within 0.5%. See also 3174 above.

621.317.72 : 621.392.43 **3176**

A Modified Micromatch.—D. N. Corfield & C. W. Cragg. (*R.S.G.B. Bull.*, May 1948, Vol. 23, No. 11, pp. 211–213.) An instrument similar to that described in 2853 and 3188 of 1947 (Jones & Sontheimer) but suitable for use at frequencies up to 60 Mc/s. Details of its construction and operation, and the selection of suitable components, are discussed.

621.317.723 **3177**

An Electrometer Tube Amplifier Circuit.—E. Lindholm & E. Hullegård. (*Ark. Mat. Astr. Fys.*, 13th April 1948, Vol. 34, Part 4, Section B, No. 26, 5 pp. In English.) A 2-valve circuit which gives high stability and uses ordinary T114 valves. The same battery is used for filament current and anode voltage.

621.317.725 **3178**

Valve Voltmeter and Galvanometer with D.C. Amplifier.—R. L. Schupp & R. Mecke. (*Funk u. Ton*, June 1948, Vol. 2, No. 6, pp. 285–289.) A 3-stage amplifier with push-pull output stage is described which uses two Type EDD11 double triodes. Stabilized supply voltages give good zero stability. With a 4 000-Ω output meter the voltage sensitivity is 0.1 mV.

621.317.729 : 537.58 : 621.385.1 **3179**

Representation in the Electrolyte Tank of the Effect of Space Charge in Valves.—R. Musson-Genon. (*Onde élect.*, June 1948, Vol. 28, No. 255, pp. 236–242.) An account of a method for determining the distribution of potential, taking account of the space charge

$$\Delta U_{(x,y)} = -4\pi\rho.$$

The bottom of the tank is suitably contoured. The method involves successive approximations which converge very rapidly ; it can be extended to the study of the functions $\Delta\phi_{(x,y)} = f(x, y, \phi, \ldots)$. Examples of its use are given.

621.317.733 **3180**

Remarks on A. C. Wheatstone Bridges.—F. Perrier. (*C. R. Acad. Sci., Paris*, 31st May 1948, Vol. 226, No. 22, pp. 1806–1808.) Simple theory shows that maximum sensitivity is obtained when the bridge arm between the source and the impedance Z to be measured consists of an impedance whose modulus is equal to that of Z and whose argument differs from that of Z as much as possible.

621.317.733 **3181**

Capacitance Bridge with Mechanical Rectifier and Moving-Coil Galvanometer as Indicator.—F. Koppelmann. (*Frequenz*, April 1948, Vol. 2, No. 4, pp. 100–105.) Theory and description of a practical bridge of the Schering type. A mirror galvanometer gives greater sensitivity than is obtained with a vibration galvanometer as indicator. A disadvantage is the sensitivity to harmonics. The disturbing effect of any single harmonic can be eliminated by adjustment of the rectifier contacts, but other harmonics may still mask the balance to some extent.

621.317.738 **3182**

Capacitance Meter with Neon-Lamp Indicator.—L. Grillet. (*C. R. Acad. Sci., Paris*, 14th June 1948, Vol. 226, No. 24, pp. 1968–1969.) Details of a method particularly suitable for the comparison of capacitances less than 1 000 pF. The resistor usually fitted in the neon lamp socket is removed and the lamp then serves as a very sensitive current indicator, becoming luminous for currents much less than 1 μA.

621.317.75.015.3 : 621.395.625.6 **3183**

Sweeping Device for the Display of Transient Phenomena and Nonlinear Distortion.—W. Meyer-Eppler. (*Arch. elekt. Übertragung*, Jan. 1948, Vol. 2, No. 1, pp. 1–14.) A photomechanical projection apparatus for either visual observation or photographic recording, and particularly suitable for use with sound films. See also 2854 of 1942.

621.317.755 **3184**

Multigun C.R. Oscillography.—H. S. Bamford. (*Electronic Industr.*, May 1948, Vol. 2, No. 5, pp. 10–13.) A description of c.r. tubes having up to ten complete gun and deflecting systems mounted inside the same envelope. The methods of shielding each assembly and connecting the deflecting plates by short leads to terminals spaced round the neck of the tube are illustrated. Individual assemblies can have either standard orthogonal deflecting systems or a radial deflecting system with two conical electrodes. Possible applications in the fields of bio-electricity and colour television are discussed.

621.317.755 : 531.767 **3185**

Measurement of [c.r.] **Spot Trace Speed.**—C. Besle. (*Rev. gén. Élect.*, May 1948, Vol. 57, No. 5, pp. 189–192.) A method is discussed in which the spot is made to describe a spiral with constant angular velocity. The maximum recording speed is found by noting, on the photographic record of the spiral, the point where the spot ceases to be visible.

621.317.761 **3186**

Direct-Reading Superheterodyne Frequency Meter.—L. M. Berman. (*Toute la Radio*, June 1948, Vol. 15, No. 126, pp. 176–178.) Details of an instrument, constructed by the Laboratoires Radioélectriques, which has definite advantages as regards both sensitivity and selectivity over wavemeters using direct amplification. Ranges are 550 kc/s–5 Mc/s and 5 Mc/s–30 Mc/s. The absolute accuracy of the quartz crystal reference frequency is within 1 part in 10^6 and the possible error in reading the difference frequency directly can be reduced to 1 c/s. A signal can be measured in the presence of an interfering signal of equal strength only 100 c/s away. If the interfering signal is about 50 times as strong as the signal to be measured, a separation of 400 c/s is necessary.

621.317.761 : 621.385.38 **3187**

Study of the Discharge of a Capacitor through a Thyratron. Application to the Study of the Operation of a Direct-Reading Valve Frequency Meter.—R. Legros. (*Rev. gén. Élect.*, May 1948, Vol. 57, No. 5, pp. 193–200.) The operational characteristics of thyratrons are reviewed; graphs show the theoretical variations of thyratron current and voltage during the discharge. An expression is derived for the mean current registered by a thyratron/capacitor type of frequency meter. Experimental data are in agreement with them.

621.317.78 **3188**

Method of Measuring H.F. Power.—L. Liot. (*Radio franç.*, May 1948, pp. 21–25.) Two methods are described, one using lamps with short straight filaments, the other using thermojunctions. One lamp is connected to a voltage source derived from the circuit to be measured; the second is fed from a d.c. source, which is adjusted till the two filaments are equally bright. An accuracy within about 10% can be obtained at frequencies up to 1 000 Mc/s for mean powers of about 20 W. The thermojunction method gives comparable results up to frequencies of the order of 300 Mc/s.

621.317.79 : 621.396.822 **3189**

A Noise Meter for Broadcasting Stations.—M. A. Slutsker & M. A. Studitski. (*Vestnik Svyazi*, 1948, No. 6, pp. 12–13. In Russian.)

621.317.79 : 621.396.97 **3190**

C.B.S. Transmission Measuring Set.—D. F. Maxwell. (*Audio Engng, N.Y.*, April 1948, Vol. 32, No. 4, pp. 16–19..46.) A new instrument designed for precision a.f. testing in broadcast service. The set is a combination of calibrated attenuators, matching devices and power level indicators. Response/frequency measurements are accurate to within 0.1 db. Input and output power levels are given to within 0.2 db.

621.396.615.17 **3191**

A Precision Double-Pulse Generator.—D. J. Medley & H. D. Rathgeber. (*J. sci. Instrum.*, July 1948, Vol. 25, No. 7, pp. 234–236.) Description of an instrument for producing either single or repeated pairs of electrical pulses, similar to Geiger-counter discharges, separated by a time interval which is continuously adjustable from 0 to 74 μs.

621.396.822 : 621.385.2 **3192**

[Diode] **Noise Generator for Receiver Measurements.**—P. G. Sulzer. (*Electronics*, July 1948, Vol. 21, No. 7, pp. 96–98.) The receiver bandwidth need not be known and measurement is independent of the response curve of the receiver.

621.396.822 : 621.396.621 **3193**

The Estimation and Measurement of the Sensitivity of Radio Receivers in terms of *kT* Units.—Slepyan. (*See* 3232.)

621.317.79 : 621.396.615 **3194**

Test Gear for Frequency Modulation and Television. [Book Notice]—B.I.O.S. Final Report No. 1269 and addendum. H.M. Stationery Office, London, 6th Feb. 1947, 22 & 3 pp., 3s. 6d. & 1s. Signal generators were the only forms of test equipment designed in Germany specifically for f.m.; they were conventional in design, as were the methods of modulation and demodulation. The addendum describes a test oscillator which may be swept cyclically over three frequency bands (0–8, 6–14 and 12–20 Mc/s) in order to measure the i.f. characteristics of television receivers, the frequency response being displayed on a c.r. tube.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

534.321.9.001.8 : 614.8 **3195**

Notes on Using High-Power Ultrasonics.—S. Y. White. *Audio Engng, N.Y.*, April 1948, Vol. 32, No. 4, pp. 26–27, 37.) Discussion of possible dangers to health in high-intensity ultrasonic fields, and of the conditions necessary for ultrasonic coagulation of fine particles in air.

535.33 : 535.61-15 **3196**

Electronic Eyepiece for Spectroscopy of Near Infra-Red.—Z. V. Harvalik. (*Rev. sci. Instrum.*, April 1948, Vol. 19, No. 4, pp. 254–257.)

539.16.08 **3197**

Self-Quenching Halogen-Filled Counters.—S. H. Liebson & H. Friedman. (*Rev. sci. Instrum.*, May 1948, Vol. 19, No. 5, pp. 303–306.) Counters filled with inert gases containing small amounts of one of the halogens are self-quenching and have an apparently unlimited life. Their characteristics are similar to those of counters with argon-alcohol filling.

539.16.08 **3198**

The Effect of the Composition of the Gas Mixture in Self-Quenching Geiger-Müller Tubes on Their Plateau Characteristics.—S. J. du Toit. (*Phys. Rev.*, 15th June 1948, Vol. 73, No. 12, p. 1473.)

539.16.08 **3199**

Geometric Factors Underlying Coincidence Counting with Geiger Counters.—H. E. Newell, Jr. (*Rev. sci. Instrum.*, June 1948, Vol. 19, No. 6, pp. 384–389.) The coincidence rate of a perfectly efficient 2-counter telescope embedded in an isotropic field of radiation is obtained in terms of the radiation intensity and the effective dimensions and separation of the two counters. The formulae determine the counting rate within limits which in most practical cases differ by only a few per cent.

539.16.08 **3200**

Characteristics of the Parallel-Plate Counter.—L. Madansky & R. W. Pidd. (*Phys. Rev.*, 15th May 1948, Vol. 73, No. 10, pp. 1215–1216.)

615.84 : 616.853 **3201**

The Electroshock.—B. Roger. (*Radio franç.*, May 1948, pp. 37–40.) Some details of apparatus for producing shocks of various intensities for therapeutic purposes, particularly the treatment of epilepsy.

621.365 : 621.385.1 **3202**

Tube Trends in Field of Industrial Heating.—Doolittle & Steinberg. (*See* 3275).

621.38.001.8 : 786.6 **3203**

Design of Electronic Organs : Part 3.—W. Wells. (*Audio Engng, N.Y.*, April 1948, Vol. 32, No. 4, pp. 24–25..40.) A detailed discussion of the Hammond organ. The tone generator assembly contains 91 phonic wheels, gear-driven from a synchronous motor operated from a.c. mains, so that the instrument is always in tune. Manual and pedal contact troubles are avoided by using Pt–Ir and Pd for the switch contacts. The switch assembly is sealed in a metal housing and requires neither cleaning nor adjustment. Novel tone controls are provided for addition of harmonics. See also 2583 of September (Long).

621.384.6 + 538.56 + 621.385.029.63/.64 **3204**

Waves and Electrons Traveling Together — A Comparison between Traveling Wave Tubes and Linear Accelerators.—Brillouin. (*See* 3093.)

621.384.6 **3205**

Effect of the Electron Beam on the Voltage Distribution of a High-Voltage Multi-Stage Electron Accelerator.—F. W. Waterton. (*Nature, Lond.*, 10th April 1948, Vol. 161, No. 4093, pp. 563–564.)

621.384.6 **3206**

A New Method for Displacing the Electron Beam in a Betatron (Synchrotron).—R. Wideröe. (*Rev. sci. Instrum.*, June 1948, Vol. 19, No. 6, pp. 401–402.) Description of a method proposed in 1945 similar to that described in 832 of 1947 (Clark, Getting & Thomas), and of an improvement designed to reduce orbital instability.

621.384.6 **3207**

Investigations on a 15-MeV Betatron.—R. Kollath & G. Schumann. (*Z. Naturf.*, Nov./Dec. 1947, Vol. 2a, Nos. 11/12, pp. 634–642.) An account of its construction and operation, and of tests regarding its X-ray output.

621.385.833 **3208**

Summarized Proceedings of Conference on Electron Microscopy — Leeds, September 1947.—V. E. Cosslett. (*J. sci. Instrum.*, May 1948, Vol. 25, No. 5, pp. 167–170.) Discussion of (*a*) biological applications, (*b*) new instruments and technical methods. See also 1713 of June (Reed).

621.385.833 **3209**

The French Electrostatic Microscope.—P. Grivet. (*Ann. Radioélect.*, April 1948, Vol. 3, No. 12, pp. 144–145.) A review of its development and of relevant theory.

621.385.833 : 535.317.25 **3210**

A New Microscopic Principle.—D. Gabor. (*Nature, Lond.*, 15th May 1948, Vol. 161, No. 4098, pp. 777–778.) A note giving a broad explanation of the principle which may enable the resolving power of electron microscopes, at present limited by spherical aberration, to be increased by dispensing with the objective. Micrographs are obtained by electronic analysis followed by optical synthesis. The principle is used in the ' X-ray microscope ', but can be applied much more generally. It has been tested by means of an optical model.

621.391.63 : 526.9 **3211**

Surveying with Pulsed-Light Radar.—W. W. Hansen. (*Electronics*, July 1948, Vol. 21, No. 7, pp. 76–79.) An adaptation of radar techniques for surveying over inaccessible terrain. Light pulses from a flash lamp at one site are reflected back from the remote site by a system of mirrors. The reflected pulses operate a photocell and produce pips on the trace of a c.r.o. Distances and angles can be measured with an accuracy comparable to that of a third-class survey.

621.396.9 **3212**

Apparatus for Finding Pieces of Iron in Timber.—J. Hacks. (*Z. angew. Phys.*, Jan. 1948, Vol. 1, No. 1, pp. 11–19.) A permanent magnet carrying a multiturn search coil and compensating coil is used. Any iron near the search coil causes a variation in the pitch of the note given by an audio beat-frequency generator. A 2-cm shot can be detected at a distance of 25 cm and a 2-mm iron nut at 5.5 cm.

PROPAGATION OF WAVES

538.566 **3213**

Calculation of the Potential from the Asymptotic Phase.—C. E. Fröberg. (*Ark. Mat. Astr. Fys.*, 13th April 1948, Vol. 34, Part 4, Section A, No. 28, 16 pp. In English.) Full paper. Summary abstracted in 223 of January.

621.396.11 **3214**

Investigations on Short-Wave Echo Signals : Part 1.—H. A. Hess. (*Z. Naturf.*, Sept. 1946, Vol. 1, No. 9, pp. 499–505.) Measurements for frequencies in the range 10–20 Mc/s give a value of 0.137 788 sec for the time of travel round the earth. This value appears to be independent of frequency, time of day and time of year, and for distances of over 1 000 km gives distances correct to within about 25 km. The results in general favour the theory of guided propagation and not the theory of zigzag reflection between the ionosphere and earth. For part 2 see 3215 below. See also 2889 of October.

621.396.11 **3215**

Investigations on Short-Wave Echo Signals : Part 2.—H. A. Hess. (*Z. Naturf.*, Sept. 1947, Vol. 2a, No. 9, pp. 528–534.) An account of investigations for distances between transmitter and receiver less than 1 000 km, where multipath effects are pronounced. These may give rise to path time differences of several milliseconds. The strength of the interfering echoes was found to depend on the directional characteristics of the receiving aerial and on the polarization of the incoming waves. The results are discussed. Part 1 : 3214 above.

621.396.11 **3216**

Long-Distance Propagation of Short Waves.—L. Hamberger & K. Rawer : H. A. Hess. (*Z. Naturf.*, Sept. 1947, Vol. 2a, No. 9, pp. 521–527.) Hamberger & Rawer consider that the approximate constancy of the time taken for s.w. propagation right round the earth can be explained, contrary to the views of Hess (3214 above), by zigzag reflection between the ionosphere and the earth. The values given by Hess would correspond to 12 to 17 reflections.

Hess points out that the observed angle of arrival of waves which have travelled round the earth does not favour the zigzag reflection theory.

621.396.11 : 523.746 **3217**

Sunspots and Radio Weather.—Arzinger, Hallborg & Nelson. (*See* 3106.)

621.396.11 : 551.510.535 **3218**

Upper-Atmosphere Circulation as Indicated by Drifting and Dissipation of Intense Sporadic-E Clouds.—Ferrell. (*See* 3117.)

621.396.11 : 551.510.535 **3219**

A Study of the Interaction of Radio Waves.—J. A. Ratcliffe & I. J. Shaw. (*Proc. roy. Soc. A*, 2nd July 1948, Vol. 193, No. 1034, pp. 311–343.) Experiments have been carried out to provide information about the mechanism by which modulation can be transferred from one wave to another during transmission through the ionosphere. Earlier theories, indicating that this phenomenon is due to nonlinear absorption, are restated in current nomenclature and are shown to be confirmed by the experimental data. The results provide a measure of the heights at which absorption takes place at different frequencies and of the electron collision frequency in the absorbing regions.

621.396.11 : 551.510.535 **3220**

Restricted-Range Sky-Wave Transmission.—J. E. Hacke, Jr, & A. H. Waynick. (*Proc. Inst. Radio Engrs, W. & E.*, June 1948, Vol. 36, No. 6, pp. 787–793.) 2.4-Mc/s signals from an omnidirectional aerial can normally be received by reflection from the E layer at ranges up to 2 000 km. By designing an aerial array to give increased vertical directivity the maximum range can be reduced to 500 km. The limitations and advantages of the system are discussed.

621.396.11 : 551.510.535 **3221**

Triple Splitting of Ionospheric Rays.—J. H. Meek. (*Nature, Lond.*, 17th April 1948, Vol. 161, No. 4094, p. 597.) The theory of ionospheric reflection of m.f. and h.f. radio waves at vertical incidence indicates the existence of a triple splitting effect in polar regions, due to the nearly vertical magnetic field of the earth. In Canada a complete trace is often seen extending from the E region through the F_1 region to the F_2 region. A sample record is given showing observed characteristics of the third split. See also 3222 below.

621.396.11 : 551.510.535 **3222**

Triple Splitting of Ionospheric Rays.—T. L. Eckersley. (*Nature, Lond.*, 17th April 1948, Vol. 161, No. 4094, pp. 597–598.) The triple splitting of rays reflected from the F region is thought, on the basis of the observed polarization, to be due to coupling between the ordinary and extraordinary rays. See also 2595 of September (Newstead) and 3221 above.

621.396.812 **3223**

On the Wave-Guiding Properties of Non-Uniform Media.—P. E. Krasnushkin. (*Zh. tekh. Fiz.*, April 1948, Vol. 18, No. 4, pp. 431–446. In Russian.) By using the method of normal modes, a complete picture of the wave propagation beyond the horizon in the case of a non-uniform troposphere and ionosphere can be given. The method consists in representing the wave field in the form of a spectrum of normal modes, the discontinuous portion of which is analogous to the spectrum of normal waves in a hollow pipe. An exact solution of the problem is given for the case of a plane multi-layer medium and an approximate solution for the case of a spherical multi-layer medium. See also 516 of 1947 (Booker), 2892 of 1947 (Booker & Walkinshaw) and 2211 of 1947 and 224 of January (Pekeris).

621.397.812.029.62/.63 **3224**

Comparative Propagation Measurements ; Television Transmitters at 67.25, 288, 510 and 910 Mc/s.—G. H. Brown, J. Epstein & D. W. Peterson. (*RCA Rev.*, June 1948, Vol. 9, No. 2, pp. 177–201.) The transmitting aerials were near to or at the top of the Empire State Building. Two 50-mile paths were chosen, one over hilly terrain with maximum elevation 1 200 ft and the other over fairly flat terrain with no hills above 230 ft. The receiver aerials were mobile, and 30 ft above ground. Measurements were made at 2-mile intervals along each path. Theoretical and experimental field-strength values agreed more closely for the flat path than for the hilly one, and more closely for 67.25 Mc/s than for 288 Mc/s. The field strengths for 510 and 910 Mc/s were usually far below the theoretical values. Shadowing from obstacles increased steadily with frequency and was severe at 910 Mc/s. Curves are given from which television transmitter power requirements can be estimated for different frequencies. Multipath effects were slight at 67.25 and 288 Mc/s, but severe in obstructed areas at 510 and 910 Mc/s. A clean picture could usually be obtained by suitable orientation of the receiver aerial.

621.396.812.029.64 **3225**

Results of Horizontal Microwave Angle-of-Arrival Measurements by the Phase-Difference Method.—A. W. Straiton & J. R. Gerhardt. (*Proc. Inst. Radio Engrs, W. & E.*, July 1948, Vol. 36, No. 7, pp. 916–922.) The measurements were made on λ 3.2 cm over a 7-mile path lying along a shore line in the Gulf of Mexico. Small deviations of the angle of arrival (of the order of 0.02°) in a landward direction from the geometric path were very frequently noted. Meteorological soundings showed overwater ducts to be present nearly all the time and there was a general correlation between the angular deviations and the horizontal gradient of radio refractive index. See also 1182 of 1947 (Sharpless) and 1183 of 1947 (Crawford & Sharpless).

621.396.11 : 551.510.535 **3226**

Radio Research Special Report No. 17. Fundamental Principles of Ionospheric Transmission. [Book Notice]—H. M. Stationery Office, 1s. 6d. (*Govt Publ., Lond.*, June 1948, p. 18.) Joint publication of the Department of Scientific and Industrial Research and the Admiralty.

RECEPTION

621.396.621 **3227**

Converting the 1147B for 50-250 Mc/s Operation.—B. W. St. L. Montague. (*R.S.G.B. Bull.*, May 1948, Vol. 23, No. 11, pp. 214–216, 218.) Details of the necessary modifications of the R.A.F. receiver R.1147 B, which include rewinding the i.f. transformers and oscillator coils. Provision is made for the addition of a f.m. discriminator, which will be described later.

621.396.621 **3228**

The Marconi High Discrimination Communication Receiver, Type R.G. 44.—L. R. Mullin. (*Marconi Rev.*, April/June 1948, Vol. 11, No. 89, pp. 33–38.) A receiver designed for war-time mass production. The printed tuning scale forms a spiral on a drum, and is calibrated at 10-kc/s intervals between 2 and 20 Mc/s. Mechanical and electrical features are discussed, including methods of temperature compensation for the oscillator and an a.v.c. system having improved noise characteristics.

621.396.621 **3229**

A High-Fidelity Receiver.—L. Chrétien. (*T.S.F. pour Tous*, April–June 1948, Vol. 24, Nos. 234–236, pp. 84–86, 127–129 & 152–154.) Continuation of 2336 of August. Discusses h.f. amplification, coupling circuits and frequency changing.

621.396.621 **3230**

Single-Signal Single-Sideband Adaptor.—E. W. Rosentreter. (*Electronics*, July 1948, Vol. 21, No. 7, pp. 124 .. 143.) Full circuit details are given for the General Electric single-sideband selector. Principles of operation are discussed, with reference to the work of Villard (2597 of September) and Dome (1021 of 1947). The selector unit is connected to the last i.f. stage of an existing a.m. receiver by means of a small probe and a short length of low-capacitance shielded cable.

621.396.621 : 06.064 Paris **3231**

French Receiver Construction at the Paris Fair, 1948.—G. Giniaux & J. Rousseau. (*T.S.F. pour Tous*, June 1948, Vol. 24, No. 236, pp. 159–164.) A general account, with a table giving particulars of about 130 receivers, and also a discussion of receivers with special characteristics.

621.396.621 : 621.396.822 **3232**

The Estimation and Measurement of the Sensitivity of Radio Receivers in terms of *kT* units.—L. B. Slepyan. (*Radiotekhnika, Moscow*, March/April 1948, Vol. 3, No. 2, pp. 3–10. In Russian.) Starting from the well-known Nyquist formula (1) determining the signal level in an equivalent aerial circuit necessary for producing the same effect at the output of the receiver as that due to noise originating in it, formulae are derived for calculating the sensitivity of a receiver in kT energy units, k being Boltzmann's constant and T the absolute temperature. The difference between the coefficient of insensitivity D (formula 10) and noise factor F (formula 12) is established and methods are indicated for measuring them. See also 1656 and 2337 of 1942 (North).

621.396.621.53 : 621.385.2 **3233**

The Fundamental Relationships in the Diode Frequency Changer.—L. S. Gutkin. (*Zh. tekh. Fiz.*, May 1948, Vol. 18, No. 5, pp. 615–638. In Russian.) A theoretical analysis of a diode mixer stage is given, neglecting the effects of parasitic inductance, capacitance, etc. The various relationships determining the operation of the stage are derived and conditions are established for obtaining the maximum amplification when the diode is loaded with one- or two-section filters. The effect of noise is investigated in detail. Formulae derived by Strutt (1573 of 1947) are criticized.

621.396.621.54 : 621.316.72 **3234**

On the Automatic Stabilization of the Amplification of a Superregenerative Receiver for the Reception of Pulse Signals.—M. K. Belkin. (*Radiotekhnika, Moscow*, May/June 1948, Vol. 3, No. 3, pp. 25–35. In Russian.) The theory of the receiver is discussed and the necessity of automatic stabilization is pointed out. The total amplification N of the receiver is equal to $N_p\eta$ where N_p is the gain due to regeneration and η the gain given by superregeneration as compared to regeneration. An experimental investigation in which stabilization of the receiver was effected by controlling N_p or η is discussed. The second method is preferable but neither method is quite satisfactory. It is suggested that stabilization within the circuit of the receiver should be combined with that of the power supplies.

621.396.622 **3235**

Theory of Frequency Counting and its Application to the Detection of Frequency-Modulated Waves.—É. Labin. (*Proc. Inst. Radio Engrs, W. & E.*, July 1948, Vol. 36, No. 7, pp. 828–839.) A theoretical study of the operation of electronic circuits which produce an output proportional to the frequency of the input signal. If the input signal is modulated, the output should reproduce the modulation. As a detector, the frequency counter has low overall sensitivity, but this appears to be unimportant; it is much more rugged than ordinary 'differential' discriminators, and does not require close tolerances, or adjustment when installed in a receiver.

621.396.662 **3236**

The Browning RV-10 F.M. Tuner.—F. A. Spindell. (*FM & Televis.*, May 1948, Vol. 8, No. 5, pp. 37–40 .. 59.) Circuit details, performance characteristics and alignment procedure for a straight tuner using the Armstrong circuit.

621.396.82 **3237**

Interference between Very-High-Frequency Radio Communication Circuits.—W. R. Young, Jr. (*Proc. Inst. Radio Engrs, W. & E.*, July 1948, Vol. 36, No. 7, pp. 923–930.) Various common causes of interference are discussed and sample measurements are quoted to illustrate their relative magnitudes. Formulae are given for computing the frequency of the disturbances. A method is described for making charts, suitable for a given type of equipment, from which spurious frequencies can be read directly as a function of the operating frequency.

621.396.822 **3238**

Some General Results in the Theory of Noise through Non-Linear Devices.—D. Middleton. (*Quart. appl. Math.*, Jan. 1948, Vol. 5, No. 4, pp. 445–498.) The Fourier series method of Rice (2169 of 1945 and back references) is applied to the following unsolved problems: (*a*) Passage of a modulated signal in the presence of noise through a general nonlinear apparatus, with a sinusoidally modulated carrier, or with narrow-band noise, symmetrically distributed in frequency about the carrier. (*b*) The biased νth-law rectifier, for modulated and unmodulated carriers; limiting cases of large noise or signal voltages are also discussed. (*c*) The case of a modulated signal and narrow-band noise, with a determination of the various probability densities associated with the envelope of the wave. (*d*) The correlation function and mean power associated with the envelope of signal and noise. The l.f. output of the half-wave νth-law device is considered. (*e*) The νth-law, half-wave rectification of noise alone. This is relevant to the measurement of noise and to the detection of pulse signals in the presence of noise. (*f*) A general 'small-signal' theory in which the peak values of the incoming wave, whether noise or signal plus noise, are so small that overloading and cut-off do not occur.

621.396.822 **3239**

Thermal Noise in Resistors.—S. Rodda : D. A. Bell. Correction to 2072 of July. The paper by Bell there mentioned should have been 2780 of 1938. See also 1914 of 1939 (Moullin).

621.396.822 : [523.72 + 523.16 **3240**

Radio Noise of Extra-Terrestrial Origin and its Effect on Telecommunication Technique.—Lehmann. (*See* 3102.)

STATIONS AND COMMUNICATION SYSTEMS

534.861.1 : 621.316.345 : 621.396.664 **3241**

Modern Design Features of C.B.S. Studio Audio Facilities.—R. B. Monroe & C. A. Palmquist. (*Proc. Inst. Radio Engrs, W. & E.*, June 1948, Vol. 36, No. 6, pp. 778–786.) Description of a small, space-saving, single-unit console which is easily accessible for maintenance. See also 2316 of 1946 (Chinn).

534.861.1 : 621.396.712.3 **3242**

Speech-Input Equipment for New Oslo Broadcasting House.—Julsrud & Weider. (*See* 3008.)

621.39 **3243**

Telecommunication Services for the Fifth Olympic Winter Sports at St. Moritz, from 30th January to 8th February 1948.—A. Wettstein. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st June 1948, Vol. 26, No. 3, pp. 99–115. In German and French.) Details of the general arrangements, with particular reference to telephone facilities.

621.391.63 : 534.321.9 **3244**

Distortion in Light Modulation by an Ultrasonic Cell.—Sette. (*See* 3000.)

621.394.441 **3245**

A Multi-Channel Carrier Telegraph System.—A. L. Matte. (*Bell Syst. tech. Publ. Monogr.*, B-1529, 4 pp.; *Railway Signaling*, Dec. 1947, Vol. 40, pp. 778–781.) Description of the 40AC1 voice-frequency system, which is specifically designed to meet railway requirements and will provide 12 duplex or simplex telegraphy channels on a 4-wire circuit, or 6 on a 2-wire circuit.

621.396.41 **3246**

Theoretical Analysis of Various Systems of Multiplex Transmission.—V. D. Landon. (*RCA Rev.*, June 1948, Vol. 9, No. 2, pp. 287–351.) A systematic method of classifying and specifying such systems is discussed. Definitions of 77 associated terms are included. The basic types of frequency division, time division and triple modulation systems are considered in detail. Formulae for the signal/noise ratio for each system relative to that for single-channel a.m. are obtained and tabulated; due allowance is made for pre-emphasis. More detailed discussion of the relative merits of the systems will be given later.

621.396.41.029.64 **3247**

A Duplex System of Communications for Microwaves.—R. V. Pound. (*Proc. Inst. Radio Engrs, W. & E.*, July 1948, Vol. 36, No. 7, pp. 840–844.) A single oscillator is used both as transmitter and as beating oscillator of a superheterodyne receiver. The oscillator frequency is stabilized at the frequency of a high-Q cavity; f.m. takes place about this stabilization frequency. Duplex communication can easily be arranged by this method and an experimental set is described; the operator initiating communication can ascertain that his signals are being received. The application of the system to ground/aircraft communication and to a booster system for a relay link is discussed. See also 1690 of 1947 and 1311 of May.

621.396.61/.62].029.63 **3248**

Practical Experiments on 2 350 Megacycles.—N. T. J. Bevan & L. Grimshaw. (*R.S.G.B. Bull.*, July 1948, Vol. 24, No. 1, pp. 2–4.) Construction and brief performance details of the transceivers used. An oscillator consisting of a Type CV90 valve with the modified cavity of a Sutton valve forms the basis of the transmitter. Provision is made for R/T or m.c.w. operation. The associated receiver is superregenerative.

621.396.619.16 (083.72) **3249**

Standardization of Nomenclature for Pulse Modulation.—H. H. Heeroma. (*Proc. Inst. Radio Engrs, W. & E.*, July 1948, Vol. 36, No. 7, p. 880.) Statement of terms proposed by the Netherlands Electrotechnical Committee for use internationally. Terms favoured are: pulse-rate, pulse-width, pulse-position, pulse-height, pulse-slope, and pulse-code modulation. Terms deprecated are: pulse-frequency, pulse-length, pulse-phase, pulse-displacement, pulse-time, pulse-delay, and pulse-amplitude modulation.

621.396.65.029.63 **3250**

S-T [studio-transmitter] **Link on 920 to 980 Mc/s.**—R. H. DeWitt. (*FM & Televis.*, May 1948, Vol. 8, No. 5, pp. 22–25.) A radio link for use where wire lines are either lacking or uneconomic. Block diagrams, numerous illustrations and a short description of the equipment are given, with performance details. Corner-reflector aerials are used for line-of-sight distances up to 12 miles. Paraboloids are necessary for greater distances up to a maximum of 35 miles.

621.396.933 **3251**

V.H.F. for Civil Aircraft.—(*Wireless World*, July 1948, Vol. 54, No. 7, pp. 242–243.) The aircraft set weighs only 12 lb, takes 3.75 A from a 12-V battery and delivers about 300 mW to the aerial. It comprises two crystal multiplier chains, two r.f. and frequency-changer chains, a common i.f. amplifier with detector, a.g.c. and a.f. stages, and a modulator chain. For airport control, a 5-W rack-mounted installation is provided, comprising two separate transmitters and receivers and their power supplies. All four are crystal-controlled and have provision for remote or local operation. The receiver used for d.f. is very similar to the communication receiver. Two-way communication has been maintained at ranges up to 33 miles with the aircraft at 2 000 ft and up to 70 miles with the aircraft at 10 000 ft.

SUBSIDIARY APPARATUS

621-526 : 621.396 **3252**

Servomechanisms in Connection with Radio Problems: Part 1.—G. Lehmann. (*Onde élect.*, June 1948, Vol. 28, No. 255, pp. 213–217.) A general discussion of a wide variety of applications in radio technique.

621.314.634 **3253**

Small Selenium Rectifiers.—J. J. A. Ploos van Amstel. (*Philips tech. Rev.*, 1947/1948, Vol. 9, No. 9, pp. 267–276.) Discussion of: (*a*) the general properties of Se rectifiers, (*b*) the construction and measurement of the dynamic characteristics of three types, (*c*) some applications.

621.316.722 **3254**

Voltage Regulators of the Shunt Type.—W. G. Hoyle. (*Rev. sci. Instrum.*, April 1948, Vol. 19, No. 4, pp. 244–246.) A general equation is derived, giving the relation between the nominal required input voltage and the maximum shunt regulating current for any variation of the input voltage and for any load. The necessary relation between the shunt regulating current and the output current for maximum electrical efficiency is obtained. For a fixed load, the maximum average efficiency of any shunt regulator is $(1 - k^{\frac{1}{2}})^2$, where k is the maximum variation, per unit, of the supply voltage.

621.316.722 **3255**

The Effect of Frequency Variations on the Operation of Ferro-Resonant Voltage Stabilizers.—B. V. Belyaev. (*Avtomatika i Telemekhanika*, Jan./Feb. 1948, Vol. 9, No. 1, pp. 59–73. In Russian.) The effects of various parameters of stabilizers, such as the inductance value, the capacitance of capacitors and the compensating coil, the value and type of the load resistance, etc., on the output voltage variation with frequency are investigated by a graphical/analytical method. The main conclusions are confirmed by experimental results.

621.316.722.1 **3256**

Electromagnetic Voltage Stabilizers for Valve Apparatus.—W. Geyger. (*Funk u. Ton*, June 1948, Vol. 2, No. 6, pp. 308–314.) Discussion of basic principles, with description, characteristics and performance of some modern types.

621.316.722.1 **3257**

An Inductively Coupled Series Tube D.C. High Voltage Regulator.—R. Pepinsky & P. Jarmotz. (*Rev. sci. Instrum.*, April 1948, Vol. 19, No. 4, pp. 247–254.) A stabilizer operating in the range 5–50 kV for currents up to 50 mA. The series regulator valve, which is at h.v., is coupled inductively to the feedback amplifier at earth potential. The signal from the amplifier provides a.m. for a r.f. oscillator, whose output voltage is fed to a transformer, rectified, filtered, and then applied as a d.c. correcting signal to the grid of the series valve. Insulation between h.v. and l.v. circuits is provided in the r.f. transformer.

621.319.339 **3258**

Van de Graaff Electrostatic Generator.—J. M. Ferguson, E. W. Webster & T. E. Calverley. (*Elect. Times*, 13th May 1948, Vol. 113, No. 2949, pp. 575–579.) A short, illustrated description.

TELEVISION AND PHOTOTELEGRAPHY

621.397.331 : 513.3 **3259**

The Application of Projective Geometry to the Theory of Color Mixture.—F. J. Bingley. (*Proc. Inst. Radio Engrs, W. & E.*, June 1948, Vol. 36, No. 6, pp. 709–723.) I.R.E. 1948 National Convention paper; summary noted in 2647 of September.

621.397.335 **3260**

Phasing of Remote TV Signals.—R. C. Palmer. (*Communications*, April 1948, Vol. 28, No. 4, pp. 14–16.) An instrument designed to provide phase synchronization between the vertical synchronization intervals of a remote composite picture signal and the studio synchronizing generator.

621.397.5 **3261**

Electro-Optical Characteristics of Television Systems: Part 2 — Electro-Optical Specifications for Television Systems.—O. H. Schade. (*RCA Rev.*, June 1948, Vol. 9, No. 2, pp. 245–286.) Part 1, 2940 of October.

621.397.5 : 535.88 : 679.5 **3262**

Plastic Lenses in Television Projection.—Starkie. (*See* 3154.)

621.397.5 : 778.53 **3263**

Motion Picture Photography of Television Images.—R. M. Fraser. (*RCA Rev.*, June 1948, Vol. 9, No. 2, pp. 202–217.) A description of the apparatus and methods developed for photographing television c.r. tube images. 16-mm film is used because 35-mm film costs more and is subject to rigorous fire regulations.

A ZnS blue-fluorescing screen is desirable for photographic recording. In the experimental equipment considered, a 5-inch tube with a flat screen and aluminized blue phosphor was used. A r.f. h.v. supply delivered 29 kV to the second anode of the c.r. tube, which was mounted at one end of a lathe bed, with the camera at the other. A 2-inch Eastman Anastigmat F 1.6 lens, with apertures from F 2.0 to F 2.8, was used. The recordings can be retransmitted satisfactorily.

621.397.6 : 621.398 : 629.135 **3264**

Television Equipment for Aircraft.—(*Télévis. franç.*, May 1948, No. 37, pp. 8–9.) A short account of the complete equipment for the Roc guided projectile, using the mimo pickup tube, and of the 'ring' equipment fitted in U.S. reconnaissance aircraft. See also 2959–2962 of 1947.

621.397.61 (083.74) **3265**

R.M.A. Standards.—(*Proc. Inst. Radio Engrs, W. & E.*, July 1948, Vol. 36, No. 7, pp. 932–938.) Electrical performance standards, definitions, and recommended methods of measurement for television broadcast transmitters at frequencies between 44 and 216 Mc/s.

621.397.62 **3266**

Television Receiver with Screen Projection (Philips' Receiver).—(*Radio franç.*, May 1948, pp. 42–48.) A general description, with details of the folded Schmidt optical system and of certain special features. The picture size is 31 cm × 41 cm.

621.397.62 **3267**

'Surplus' Television Receiver.—L. J. Dalby. (*Wireless World*, July 1948, Vol. 54, No. 7, pp. 251–252.) Brief description and circuit details of a simple and cheap television receiver which gives good results. The c.r. tube is readily obtainable from war surplus equipment.

621.397.8 **3268**

Cause and Cure of Spurious TV Receiver Oscillations.—R. T. Cavanaugh. (*Tele-Tech*, May 1948, Vol. 7, No. 5, Part 1, pp. 36–37..79.) Causes of spurious oscillations in pentode output stages of line scanning generators are investigated. The use of a magnet to modify the electron paths within the valve is advocated as a cure.

621.397.812.029.62/.63 **3269**

Comparative Propagation Measurements; Television Transmitters at 67.25, 288, 510 and 910 Mc/s.—Brown, Epstein & Peterson. (*See* 3224.)

TRANSMISSION

621.396.61 **3270**

Transmitters in Parallel.—V. O. Stokes. (*Marconi Rev.*, April/June 1948, Vol. 11, No. 89, pp. 39–44.) The use of transmitters in parallel and the attendant problems are discussed. Methods of phase adjustment and monitoring are described and details given of a completely automatic system of synchronization. Although the case of two transmitters is discussed, there appears to be no technical objection to the use of more than two in parallel.

621.396.61 **3271**

A New Approach to Single Sideband.—D. E. Norgaard. (*QST*, June 1948, Vol. 32, No. 6, pp. 36–42.) Discussion of practical methods of generating a single-sideband suppressed-carrier signal without the need for sharp filtering and multiple heterodyning. One of the sidebands is removed by a process in which two audio channels with a constant phase difference of 90° are balanced. See also 1805 of June (Nichols).

621.396.61 : 621.316.729 **3272**

Synchronization of Low-Power Transmitters.—Chamagne & G. Guyot. (*Télévis. franç.*, May 1948, No. 37, Supplement *Électronique*, pp. 12–16.) Details of a system suitable for a network of low-power transmitters serving a limited area, such as a large town and its suburbs. A single pilot frequency of 106.6 kc/s is used; multipliers convert this to the transmission frequency of 960 kc/s. The quality of the l.f. modulation could be improved by using f.m. instead of a.m., but the quality with a.m. is quite satisfactory for the transmission of news, dance music, etc.

VALVES AND THERMIONICS

621.385.029.63/.64 + 538.56 + 621.384.6 **3273**

Waves and Electrons Traveling Together — A Comparison between Traveling Wave Tubes and Linear Accelerators.—Brillouin. (*See* 3093.)

621.385.029.63/.64 **3274**

Small-Signal Analysis of Traveling-Wave Tube.—C. Shulman & M. S. Heagy. (*RCA Rev.*, June 1948, Vol. 9, No. 2, p. 366.) Corrections to 2103 of July.

621.385.1 : 621.365 **3275**

Tube Trends in Field of Industrial Heating.—H. D. Doolittle & E. B. Steinberg. (*Electronic Industr.*, May 1948, Vol. 2, No. 5, pp. 4–7.) Industrial operating requirements impose severe conditions on heater valves. Improvements in valve construction technique are described which give increased life and reliability under such exacting conditions.

621.385.38 : 621.317.761 **3276**

Study of the Discharge of a Capacitor through a Thyratron. Application to the Study of the Operation of a Direct-Reading Valve Frequency Meter.—Legros. (*See* 3187.)

621.396.615.142.2 **3277**

Millimetre Wavelengths.—(*Wireless World*, July 1948, Vol. 54, No. 7, p. 258.) The Clarendon Laboratory has designed a reflex klystron tunable over the wavelength range 8–9 mm. The volume of the klystron cavity is altered by means of a cam mechanism. With a resonator potential of 2.4 kV and a reflector negative potential of 200 V, 10–20 mW of c.w. power is obtained.

621.396.622.6 : 546.28 **3278**

The Silicon Crystal Detector.—(*See* 3059.)

621.385.1 **3279**

Vacuum Tubes. [Book Review]—K. R. Spangenberg. McGraw-Hill, London, 860 pp., 45s. (*Wireless Engr*, July 1948, Vol. 25, No. 298, p. 237.) "This important book is designed to give a comprehensive account of vacuum tubes and the physical laws on which their behaviour depends. It contains a splendid collection of potential-distribution diagrams, nomograms and design charts pertaining to electron optics, thermionic receiving valves and the more recent developments, such as klystrons and magnetron oscillators."

MISCELLANEOUS

016 : 621.39 **3280**

Technical Bibliographies.—(*Electronics*, July 1948, Vol. 21, No. 7, p. 128.) A list of unpublished bibliographies compiled by the Special Libraries Association can be obtained from R. H. Hopp, Bettelle Memorial Institute, Columbus, Ohio. Other sources of bibliographical information are the Office of Technical Services, U.S. Department of Commerce, and the Engineering Societies Library, New York City.

06.051 **3281**

International Radio Conferences.—(*Nature, Lond.*, 1st May 1948, Vol. 161, No. 4096, pp. 695–696.) An account of the activities of the Union Radio Scientifique Internationale (U.R.S.I.) and of the Comité Consultatif International des Radio-Communications (C.C.I.R.).

061.3 : 621.396 **3282**

Scientific Radio.—R. L. Smith-Rose. (*Nature, Lond.*, 22nd May 1948, Vol. 161, No. 4099, pp. 793–796.) A brief account of the proceedings of the Convention on Scientific Radio organized by the I.E.E. in co-operation with the British National Committee for Scientific Radio. The proceedings were divided into four sessions, corresponding in scope to the four U.R.S.I. commissions. A preliminary survey was made of the British contribution to be presented at the U.R.S.I meeting at Stockholm in July 1948. Four or five short papers were read at each session, surveying progress in the past few years in various parts of the field of fundamental radio science. See also *Electrician*, 9th April 1948, Vol. 140, No. 3643, pp. 1121–1123.

621.39 **3283**

High-Frequency, Communications, and Remote Control Engineering.—(*Brown Boveri Rev.*, Jan./March 1947, Vol. 34, Nos. 1/3, pp. 50–57.) Illustrations and a few details of (*a*) multichannel beam telegraphy and telephony equipment, (*b*) f.m. u.s.w. R/T equipment for communication with mobile stations, (*c*) medium- and low-power transmitters for commercial operation, (*d*) high- and medium-power broadcast transmitters for medium, short and ultra-short waves, (*e*) transmitting and special valves, (*f*) carrier-current telephony and industrial control equipment.

027 **3284**

British Sources of Reference and Information.—[Book Review]—T. Besterman (Ed.). Association of Special Libraries and Information Bureaux, London, 56 pp., 6s. (*J. sci. Instrum.*, July 1948, Vol. 25, No. 7, p. 255.) A description of the organization through which books in Great Britain can be borrowed, whether from inside or outside the country. Brief accounts and select lists of the leading library and book organizations, and a list of indispensable works of reference, are given.

621.396 **3285**

Radio Data Charts. [Book Review]—R. T. Beatty, revised by J. McG. Sowerby. Iliffe & Sons, London, 4th edn 1947, 93 pp., 7s. 6d. (*Proc. Inst. Radio Engrs, W. & E.*, May 1948, Vol. 36, No. 5, p. 647.) A revision of the original collection of abacs published in 1930. "The charts are most useful to a radio receiver designer, but are also commendable for student use since many of the nomograms present a physical picture of what would otherwise be a complex formula difficult to comprehend."

ABSTRACTS and REFERENCES

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to it.

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ACOUSTICS AND AUDIO FREQUENCIES

016 : 534 **3286**

References to Contemporary Papers on Acoustics.—A. Taber Jones. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, pp. 558–567.) Continuation of 2684 of October.

534.2 **3287**

On the Acoustic Analogue of Sommerfeld's Surface Wave.—K. F. Niessen. (*Physica, 's Grav.*, March 1941, Vol. 8, No. 3, pp. 337–343. In German.) Certain effects observed by Janovsky & Spandöck (1031 of 1938) are shown to be analogous not to the space radiation but to the surface wave of Sommerfeld's theory.

534.21 **3288**

The Directional Characteristics of a Clamped-Edge Disk.—L. L. Merrill & F. H. Slaymaker. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, pp. 375–380.) Analysis of vibrations in the first normal mode.

534.21 **3289**

Calculation of the Directivity Index for Various Types of Radiators.—C. T. Molloy. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, pp. 387–405.) The directivity index is defined; it enables power calculations for all radiators to be made in the same way as for point sources. Directivity index formulae, together with graphs covering practical cases, are given for: (*a*) a circular or rectangular plane piston in an infinite baffle, (*b*) a sectoral or multicellular horn, (*c*) a piston set in a sphere.

534.213 (26.03) **3290**

Reverberation in the Sea.—C. F. Eyring, R. J. Christensen & R. W. Raitt. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, pp. 462–475.)

534.213 (26.03) : 534.241 **3291**

Example of Propagation of Underwater Sound by Bottom Reflection.—R. W. Young. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, pp. 455–462.) Full paper; summary noted in 2123 of August.

534.23 **3292**

Optimum Directivity Patterns for Linear Arrays.—R. L. Pritchard & M. D. Rosenberg. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, p. 594.) Summary only. The sharpest major lobe is obtained when all minor lobes have the same relative amplitude; such systems have been discussed by Dolph (2487 of 1946) and Riblet (2685 of 1947). Here the required distribution of excitation is computed explicitly for linear, equally spaced arrays of simple sources containing odd numbers of elements up to 13.

534.24 (26.03) **3293**

Reflection of Underwater Sound from the Sea Surface.—L. N. Liebermann. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, pp. 498–503.) Discussion of: (*a*) the theory of interference due to reflection from a plane sea surface, (*b*) pulse measurement technique, (*c*) the dependence of the reflection coefficient on the frequency used.

534.26 **3294**

The Diffraction of Sound by Circular Disks and Apertures.—R. D. Spence. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, pp. 380–386.) A theoretical discussion, using oblate spherical coordinates. Numerical results for the cross-section for scattering and transmission are shown graphically.

534.26 **3295**

The Diffraction of a Sound Wave by an Infinite Set of Plates.—J. W. Miles. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, pp. 370–374.) The conditions for plane wave propagation within the plates and for a single reflected wave are given, together with expressions for the reflection and transmission coefficients. See also 2756 and 3504 of 1947 (Carlson & Heins).

534.26 **3296**

Notes on Sound Diffraction by Rigid Circular Cones.—F. M. Wiener. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, pp. 367–369.) An experimental determination of the sound pressure at points on the surface of a circular cone exposed to a progressive wave. Results are shown graphically, and are generally similar to those obtained for other obstacles with the same circular face.

534.26 : 534.321.9 **3297**

Optical Study of Acoustic Fields near Diffracting Edges.—J. C. Hubbard, I. F. Zartman & C. R. Larkin. (*J. opt. Soc. Amer.*, Oct. 1947, Vol. 37, No. 10, pp. 832–836.) Diffraction effects in ultrasonic sound fields in air were photographed by schlieren technique and by shadow methods using sparks of extremely short duration. Variations of field intensity were observed in the immediate vicinity of apertures and obstacles, in agreement with theoretical treatment more rigorous than that of Kirchhoff. Typical photographs are reproduced.

534.321.9 : 534.213.4 : 546.49 **3298**

On Ultrasonic Propagation through Mercury in Tubes.—H. B. Huntington. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, pp. 424–432.) Measurements of the attenuation of 10.6-Mc/s pulsed ultrasonic waves in Hg as a function of tube diameter and the smoothness of the inner surface of the tube are discussed. Qualitative agreement with the Helmholtz theory is obtained for tubes large compared to λ. Sonic propagation in a circular tube is considered theoretically in an appendix.

534.321.9 : 534.7 **3299**

Biological and Psychological Effects of Ultrasonics.—H. Davis. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, p. 589.) Summary only. Discussion of the principal physiological effects of intense sounds in various parts of the sonic and ultrasonic frequency spectrum.

534.321.9.001.8 **3300**

Ultrasonics Research and the Properties of Matter.—C. Kittel. (*Rep. Progr. Phys.*, 1946/1947, Vol. 11, pp. 205–242. Bibliography, pp. 242–247.) A study of the application of ultrasonic methods to the investigation of gases, liquids and solids.

534.322.3 : 534.7 **3301**

Physiology of Noise.—A. Moles. (*Radio franç.*, July/Aug. 1948, pp. 5–9.)

534.43 : 621.395.61 **3302**

A Single Shear Plate Crystal Phonograph Pick-Up.—A. M. Wiggins & F. S. Lewis. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, pp. 448–450.) The design of gramophone pickups is discussed generally. A system for driving a piezoelectric crystal, using the mechanical transformer principle of coupling the stylus to a single slab crystal, is described as applied to a pickup ; it can also be used for microphones, loudspeakers, galvanometers, etc. Advantages claimed are the elimination of even harmonics, very low effective mass, no pickup due to vertical stylus motion and reduced record wear and needle scratch.

534.612 **3303**

Sound Pressure Measurement Equipment for the Range 50 c/s to 250 kc/s.—F. Massa. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, pp. 451–454.) The microphone standard is only $\frac{1}{8}$ inch in diameter. The stiffness of the vibrating system is adjusted to give a natural frequency of about 300 kc/s, so that pressure-wave transients having extremely steep wave fronts can be accurately reproduced. A.f. free-field measurements are claimed to be free from diffraction errors ; certain ultrasonic measurements can be made which were formerly very difficult. A preamplifier and power supply unit are included ; the equipment is portable.

534.62 **3304**

Absorbing Media for Underwater Sound Measuring Tanks and Baffles.—W. P. Mason & F. H. Hibbard. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, pp. 476–482.) Absorbent walls enable small tanks to be used for determining the directional properties of underwater sound instruments. Such walls have an inner lining of rubber, with fine-mesh screen or packed copper wadding in castor oil between the rubber and the outer shell. A 6-inch wall of this type reduces reflections by 20 db.

534.64 **3305**

Measurement of Acoustic Impedance.—O. K. El-Mawardi. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, p. 595.) Summary only. The impedance of material forming one boundary of a shallow cavity is found by measuring the sound pressure produced when a known volume current is injected from a high-impedance source. The volume current is found by observing the pressure when the cavity is terminated rigidly.

534.64 **3306**

Measurement of Coefficient of Reflection and Phase for Sound Waves.—C. Kanta. (*Proc. nat. Inst. Sci. India*, 16th Dec. 1940, Vol. 6, No. 4, pp. 671–693.) The reactance and resistance terms of the electrical impedance of a telephone receiver with an air load are determined separately, so that for a given surface both the reflection coefficient α and the phase change ϕ can be calculated. Results are given for various porous materials. No relation between α and ϕ is found. For assemblies of capillary tubes ϕ is $> \pi$ at a frequency of 1 200 c/s ; for most materials it is $< \pi$. The experimental value for the impedance of the capillary tubes is in fair agreement with the value calculated from Rayleigh's formula.

534.64 **3307**

The Acoustic Feed-Back Method of Measuring Acoustic Impedance.—A. London & C. R. Krishnamurthy. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, p. 596.) Summary only. The acoustic impedance is used as a positive-feedback network in a circuit containing a continuously-variable filter ; its frequency variation may thus be determined. Experimental results are given.

534.64 **3308**

Measurement of Acoustic Impedance by Short-Tube Techniques.—P. Chrzanowski. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, pp. 595–596.) Summary only.

534.64 **3309**

Calculations on a Short-Tube Method for Measurement of Impedance.—R. K. Cook. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, p. 595.) Summary only. With a source of known volume velocity, the sound pressure within a short tube is dependent on the wall impedance. Impedance can thus be measured for both isotropic and anisotropic materials, as is shown mathematically.

534.64 **3310**

Acoustic Impedance Measurement of Very Porous Screen.— C. M. Harris. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, pp. 440–447.) A new and simple method of measuring impedance at different frequencies, applicable even to screens whose impedance is less than $\frac{1}{100}$ of that of air. The theory of the method is given, together with typical results for surgical gauze and perforated brass sheet.

534.7 **3311**

The Spiral of the Human Cochlea.—N. R. French. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, p. 591.) Summary only. The equation of the spiral is derived from Békésy's work (*Akust. Z.*, Sept. 1941, Vol. 6, No. 5, & *ibid.*, March 1943, Vol. 8, No. 2.) and the length of the basilar membrane is deduced. Impulse velocities along the cochlear duct are also calculated.

534.7 **3312**

The Interpretation of Loudness, Pitch, and Masking Phenomena with Regard to the Two-Canal Theory of Cochlea Mechanics.—L. A. de Rosa. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, p. 591.) Summary only.

534.76 **3313**

Stereophonic Sound.—A. A. McK. (*Electronics*, Aug. 1948, Vol. 21, No. 8, pp. 88–89.) A magnetic tape carries 3 simultaneous sound channels. If the loudspeakers excited by these channels are properly arranged, the listener has the impression that the performers are actually present. So far the system has mainly been used for public auditoria but it can be adapted for home use.

534.771 **3314**

The Loudness of Repeated Short Tones.—W. R. Garner. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, pp. 513–527.) The relation between loudness and repetition rate was determined experimentally. See also 3762 of 1947.

534.78 **3315**

Reaction of Small Enclosures on the Human Voice : Parts 1 & 2.—C. T. Morrow. (*J. acoust. Soc. Amer.*, July 1947, Vol. 19, No. 4, pp. 645–652 & July 1948, Vol. 20, No. 4, pp. 487–497.) Part 1 : Specifications required for satisfactory intelligibility. Part 2 : Analyses of vowels.

534.781 **3316**

Voice Measurements with an Audio Spectrometer.—H. W. Rudmose, K. C. Clark, F. D. Carlson, J. C. Eisenstein & R. A. Walker. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, pp. 503–512.)

534.79 **3317**

The Loudness and Monaural Loudness Matching of Short Tones.—W. R. Garner. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, p. 592.) Summary only.

534.79 : 534.85/.86 : 621.396.665 **3318**

Loudness Control for Reproducing Systems.—Bomberger. (*See* 3380.)

534.844.5 **3319**

The Time Integral Basic to Optimum Reverberation Time.—J. P. Maxfield. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, pp. 483–486.)

534.844.5 **3320**

An Artificial Reverberation System.—G. W. Curran. (*Audio Engng, N.Y.*, May 1948, Vol. 32, No. 5, pp. 13–17..46.) Portions of the incoming signal are fed to two loudspeakers, the first coupled through three different lengths of pipe to microphones and the other coupled through a longer pipe to a fourth microphone. The microphone outputs are mixed and amplified. Additional delay is provided by feedback to the second loudspeaker through a differential mixer. Delays of 3 or 4 sec can thus be obtained.

534.845 **3321**

Theory of the Absorption of Sound by Compressible Walls with a Non-Porous Surface-Layer.—C. W. Kosten & C. Zwikker. (*Physica, 's Grav.*, Feb. 1941, Vol. 8, No. 2, pp. 251–272. In English.) For high absorption the body of the material should have a low specific gravity and low elasticity. The pores should preferably be such that the air inside can to some extent vibrate independently. A material with large holes is preferable ; it should be fixed some distance from a rigid wall.

534.845 **3322**

Absorption of Sound by Porous Materials : Parts 1-4.—J. van den Eijk & C. Zwikker ; C. Zwikker, J. van den Eijk & C. W. Kosten ; C. Zwikker. (*Physica, 's Grav.*, Feb., May & Dec. 1941, Vol. 8, Nos. 2, 5 & 10, pp. 149–158, 469–476, 1094–1101 & 1102–1106. In English, with German summary.)

Part 1. The absorption coefficient *a* of wood-fibre boards and acoustic plaster is deduced from measured values of porosity and air-flow resistance. The results are compared with direct measurements by an interference method, for normal incidence of the sound, and also by a reverberation method. The agreement between calculated and measured values of *a* is moderate for the higher frequencies, but for the lower frequencies the calculated values are considerably below the measured values.

Part 2. The discrepancies noted above can be reduced appreciably by the introduction into the theoretical formulae of a structure factor depending on the directional distribution of the pores and on the number and size of internal cavities.

Part 3. Measurements of the acoustic impedance of sound-absorbing walls of simple structure, consisting of (*a*) straws, (*b*) glass tubes, arranged normal to or at an angle of 30° with the wall face, are in excellent agreement with calculated values when the structure factor is taken into account. Discussion shows that the dynamic air-flow resistance is considerably greater than that given by the Helmholtz-Kirchhoff theory.

Part 4. According to Kirchhoff's theory the losses in absorbing materials are shared about evenly between the viscosity effect and the heat-conduction effect. It is here shown that the losses by conduction are very much less than by viscosity, the ratio being of the order of 1 : 60.

534.845 **3323**

Extended Theory of the Absorption of Sound by Compressible Wall-Coverings.—C. W. Kosten & C. Zwikker. (*Physica, 's Grav.*, Nov. 1941, Vol. 8, No. 9, pp. 968–978. In English.) Solutions of the appropriate systems of differential equations are obtained for the case of (*a*) a compressible layer with normal (porous) surface, and (*b*) a compressible layer with a non-porous film coating. The results are compared with experiment (3324 below).

534.845 **3324**

Measurements of the Absorption of Sound by Porous Rubber Wall-Covering Layers : Parts 1-3.—C. W. Kosten & C. Zwikker. (*Physica, 's Grav.*, Nov. 1941, Vol. 8, No. 9, pp. 933–967. In English.) Various sponge rubbers, with or without a non-porous surface layer, are found to have excellent absorption properties. Their behaviour, in general, is in agreement with theory (3321 and 3323 above). The use of non-homogeneous layers enables the selective absorption for particular frequencies to be controlled.

534.851 : 621.395.813 : 621.317.79 **3325**

New Circuit Design for Wow Tester.—Nicholson. (*See* 3467.)

534.861.1 **3326**

Sound Measurements in BC [broadcasting] **Studios.**—W. Jack. (*Tele-Tech*, June 1948, Vol. 7, No. 6, pp. 38–41..61.) Results of automatic frequency analysis of sustained sounds in various studios are discussed with particular reference to studio design.

621.395.61 **3327**

A Small High Frequency Microphone.—I. Rudnick & H. C. Rothenberg. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, p. 594.) Summary only. A Rochelle-salt crystal probe microphone and its associated two-stage preamplifier are described. The microphone response is relatively flat up to 50 kc/s in air and up to 100 kc/s in water.

621.395.61/.62 **3328**

Design of Laminated Magnetostrictive Longitudinal Oscillators.—F. P. Bundy. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, p. 594.) Summary only. The effects of various factors affecting frequency, sharpness of resonance and efficiency are discussed and the design of various types of oscillator is considered.

621.395.61/.62 **3329**

Design and Construction of a 100-kc/s Magnetostrictive Transducer.—L. Camp, R. Vincent & F. du Breuil. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, p. 593.) Summary only. Discussion of design principles for a directional array. Performance data are included.

621.395.623.7 **3330**

Horn-Type Loudspeakers.—S. J. White. (*Audio Engng, N.Y.*, May 1948, Vol. 32, No. 5, pp. 25–28, 34.) Design factors provide for (*a*) constant loading of the driver unit, and (*b*) minimum reflection at the horn mouth for the desired low-frequency cut-off. Reflex horns using conical inner sections are capable of reproducing up to 8 000 c/s. The characteristics of directional and radial horn loudspeakers are illustrated.

621.395.623.7.015.3 **3331**

The Transient Response of Loudspeakers.—H. C. Hardy & H. H. Hall. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, p. 596.) Summary only. An interrupted varying a.f. signal is applied to a loudspeaker in an anechoic room and the response of a transient-free microphone is displayed on a c.r.o. For this system, the on-transient differs from the off-transient and cannot be correlated with it. Loudspeaker decay times are often greater than 0.01 sec. See also 1313 of 1947 (Shorter).

621.395.625.3 : 621.395.813 **3332**

Factors Affecting Frequency Response and Distortion in Magnetic Recording.—J. S. Boyers. (*Audio Engng, N.Y.*, May 1948, Vol. 32, No. 5, pp. 18–19 . . 47.) Discussion of methods of improving fidelity.

621.395.623.7 **3333**

Loudspeakers : The Why and How of Good Reproduction. [Book Review]—G. A. Briggs. Wharfedale Wireless Works, Idle, Bradford, 1948, 87 pp., 5s. (*Electronics*, Aug. 1948, Vol. 21, No. 8, pp. 225–226.) ". . . presents the essentials for intelligent selection and evaluation of loudspeakers."

AERIALS AND TRANSMISSION LINES

621.392.029.64 + 621.396.611 **3334**

A Method for Calculating the Excitation of Waveguides, Surface and Cavity Resonators.—Ya. N. Fel'd. (*Zh. tekh. Fiz.*, Dec. 1947, Vol. 17, No. 12, pp. 1471–1482. In Russian.)

621.392.029.64 **3335**

On the Excitation of Waveguides : Part 2.—A. A. Samarski & A. N. Tikhonov. (*Zh. tekh. Fiz.*, Dec. 1947, Vol. 17, No. 12, pp. 1431–1440. In Russian.) The e.m. field in a waveguide excited by an arbitrarily oriented elementary current is determined. For this it is sufficient to determine the longitudinal components E_z and H_z since from these all other components can be derived. The equation (1) determining the two components and the boundary conditions (2) for the surface of the waveguide are quoted ; methods for calculating the various components are deduced. The solutions so obtained can be used for calculating e.m. fields excited by linear, surface and volume currents.

621.392.029.64 **3336**

A Rigorous Solution of the Problem of the Plane Waveguide with an Open End.—L. A. Weinstein. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, March/April 1948, Vol. 12, No. 2, pp. 144–165. In Russian.) The problem is reduced to the solution of an integral equation. A detailed investigation of this equation and methods for solving it are given under the following headings : reflection coefficient of current ; magnetic waves ; electric waves ; comparison with Kirchhoff's method (Huyghens' principle) ; phase of reflection coefficient ; correction for the open end. The method can also be applied to the solution of analogous problems concerning circular waveguides, coaxial and 2-wire transmission lines, etc. See also 3337 below.

621.392.029.64 **3337**

On the Theory of the Diffraction of Two Parallel Semi-Infinite Planes.—L. A. Weinstein. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, March/April 1948, Vol. 12, No. 2, pp. 166–180. In Russian.) Continuation of 3336 above. The limiting case when d/λ approaches infinity is investigated, where d is the distance between the two planes forming a plane waveguide with an open end and λ is the free-space wavelength.

621.392.029.64 : 621.396.67 **3338**

An Adjustable Waveguide Phase Changer.—A. G. Fox. (*Bell Lab. Rec.*, June 1948, Vol. 26, No. 6, pp. 245–250.) The phase changer consists of three short interconnected sections of cylindrical waveguide, each containing transverse conducting rods. Rotation of the centre section advances or retards the phase of the transmitted wave, according to the direction and degree of rotation. An array of radar radiators, with phase-changers fitted in each feeder and driven from a common shaft by suitable gears, may be used to provide continuous scanning of the beam without rotation of the whole aerial system.

621.392.22 **3339**

Input Impedance of a Non-Uniform Transmission Line.—P. Gazzana-Priaroggia. (*Alta Frequenza*, June 1948, Vol. 17, No. 3, pp. 99–109. In Italian, with English, French and German summaries.) Discusses the hypotheses on which the approximate theory of such lines is based and gives a new method for calculating the input impedance of a line with slight irregularities. Results thus obtained are compared with those of other authors.

621.396.67 **3340**

Recent Developments on V.H.F. Ground-Communication Aerials for Short Distances.—A. H. Brown & H. M. Stanier. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 14, pp. 637–643 ; summary, *ibid.*, Part IIIA, Vol. 94, No. 11, p. 131.) The development of four types of aerial is outlined and certain of their characteristics are described. The aerials are : (*a*) simple dipole, (*b*) directional aerial embodying a corner reflector, (*c*) rhombic aerial, and (*d*) Yagi array ; the respective frequency ranges are 100–156, 100–125, 65–85 and 65–95 Mc/s. The Yagi array requires minor adjustments to cover the required frequency range ; the other three require no adjustment.

621.396.67 **3341**

The Performance of some V.H.F. Aerials used in Naval Communications.—A. G. D. Watson, G. Hanson & J. H. Jones. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 14, pp. 666–669.) Description of a portable 3-element Yagi array for short-distance point-to-point communication, a rotatable broadside array for shore-to-ship use, a single-wire horizontal rhombic aerial for longer-distance point-to-point working, and simple dipoles for all-round radiation on board ship. Typical performance characteristics are discussed.

621.396.67 **3342**

Anti-Fading Series-Loaded Mast Radiators.—H. Page. (*B.B.C. Quart.*, Oct. 1947, Vol. 2, No. 3, pp. 165–176.) The radiation characteristics are derived for a mast consisting of two collinear sections separated by an insulator across which a variable reactance is connected. The results are applied to practical cases and the design data are summarized graphically. By varying the reactance, the mast can be used for a range of wavelengths, and the vertical polar diagram can be varied to suit a particular service area.

621.396.67 **3343**

Antennas for Circular Polarization.—W. Sichak & S. Milazzo. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1948, Vol. 36, No. 8, pp. 997–1001.) I.R.E. 1947 National Convention paper. A formula is obtained for the variation in received voltage when an elliptically polarized aerial is rotated in a plane perpendicular to the direction of propagation of the incident elliptically polarized wave. A circularly polarized aerial will not receive any of the energy transmitted by it and reflected from a highly-conducting smooth surface. The conditions for obtaining an omnidirectional circularly polarized pattern are derived. Experimental results are given.

621.396.67 **3344**

Slot Aerials : Part 2.—Ya. N. Fel'd. (*Zh. tekh. Fiz.*, Dec. 1947, Vol. 17, No. 12, pp. 1457–1470. In Russian.) Slot aerials in cavity resonators are examined for the case in which the excitation frequency differs little from the natural frequency of the resonator before the slots have been made. Formulae are derived for determining the voltage distribution along the slot and from this the fields inside and outside the aerial can be calculated. The results obtained are applied to the case of cylindrical resonators and some experimental curves are shown.

621.396.67 **3345**

Field Distributions near a Centre-Fed Half-Wave Radiating Slot.—J. L. Putman, B. Russell & W. Walkinshaw. (*J. Instn elect. Engrs*, Part III, July 1948, Vol. 95, No. 36, pp. 282–289.) A description of experiments at a frequency of about 1 000 Mc/s to map out the e.m. fields associated with a narrow $\lambda/2$ slot cut in a large metal sheet. The results are plotted to show the relative magnitudes and phases of the electric vector over a quadrant near the slot, the relative magnitudes of the magnetic vector along the slot axes, and the radiation polar diagram. The results are correlated with theory. See also 1335 of 1947 (Booker) and 3346 below.

621.396.67 **3346**

Input Impedances of Centre-Fed Slot Aerials near Half-Wave Resonance.—J. L. Putman. (*J. Instn elect. Engrs*, Part III, July 1948, Vol. 95, No. 36, pp. 290–294.) Results of measurements, at frequencies between 350 and 650 Mc/s, on slot radiators of various widths energized from parallel-rod transmission lines. The impedances were calculated from the measured standing-wave pattern. Two sets of experiments were made : (*a*) with the slots free to radiate on each side of the sheet, and (*b*) with resonant cavities to restrict the radiation to one side. The results are shown graphically and compared with those for the corresponding dipole radiator. See also 3345 above.

621.396.67 **3347**

Wide-Range Dual-Band TV Antenna Design.—L. L. Libby. (*Communications*, June 1948, Vol. 28, No. 6, pp. 12–14..31.) Description of an aerial designed to cover the 54–88-Mc/s and 174–216-Mc/s television bands and providing a substantially uniform directivity pattern and constant input impedance. It can be operated with either balanced or coaxial lines and can be grounded for lightning protection. Its use in directive arrays is also discussed.

621.396.67 **3348**

Radiation from Short Aerials.—R. G. Medhurst. (*Wireless Engr*, Aug. 1948, Vol. 25, No. 299, pp. 260–266.) A new trigonometrical approximation is developed and a theorem, based on this approximation and introducing a new concept called ' the current centre of gravity ' of an aerial, is used to show that radiation patterns from linear radiators of length $< \lambda/2$ may be combined when the radiators are spaced in any way and carry currents of arbitrary phase differences. Examples of the use of the method are given.

621.396.67 **3349**

Note on Dielectric Aerials.—I. Simon : O. Zinke. (*Onde élect.*, July 1948, Vol. 28, No. 256, pp. 278–281.) Simon derives formulae from which the radiation diagram of a dielectric rod aerial can be calculated. It is assumed that the aerial behaves as a purely longitudinal radiator, that it has no standing waves and that its diameter is negligible compared with its length. Diagrams are given for rods of length 2λ and 4λ. These have not been verified experimentally, but satisfactory agreement is found between the theoretical and experimental diagrams for a particular aerial investigated by Mallach (355 of 1947), though Mallach's velocities and critical diameters do not correspond with the theoretical formulae for TM_0 waves.

Zinke points out that Mallach's original work, described in *Ausgewählte Fragen über Theorie und Technik von Antennen*, Vol. 2, pp. 132–169, deals much more fully with dielectric aerials than the simple review noted in 355 of 1947, and includes the formula given by Simon for the field intensity, with an added factor to take account of the thickness of the rod. The discrepancies between the theory for TM_0 waves and Mallach's experimental results are explained by the fact that Mallach used a different type of wave, which has been termed Type HE or Type TEM. Calculations for such waves are in good agreement with experiment. It is noted that Mallach's invention of dielectric-rod aerials was prior to 1938.

621.396.67 **3350**

Dielectric-Rod Aerials. —D. F. Halliday & D. G. Kiely. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 14, pp. 610–618 ; summary *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 114.) The results of investigations carried out by Mallach and other German scientists and by the authors are combined in a comprehensive survey of the properties of uniform and tapered dielectric-rod radiators of circular cross-section. Arrays of rods are studied, and dielectric tubes and horns are briefly treated. Approximate theoretical treatment is used to obtain radiation patterns, and the theoretical and experimental patterns are compared. The influence of such parameters as length and diameter of the rod, amount of taper, and permittivity of the dielectric is studied, and a summary is included of design data for optimum performance. A narrow beam may be obtained, but broad-band matching is difficult to achieve.

621.396.67 **3351**

Small Aerials in Dielectric Media.—R. H. Barfield & R. E. Burgess. (*Wireless Engr*, Aug. 1948, Vol. 25, No. 299, pp. 246–253.) Experiments, with theoretical discussion, to investigate the effect of surrounding open aerials and loops with dielectric materials, in order to improve the sensitivity of d.f. systems. Results indicate that dielectrics exhibit pickup effects analogous to those of conductors. A single formula is derived for the current in an ellipsoidal receiving aerial, which applies generally to conducting or dielectric materials. The sensitivity of Adcock-type direction-finders could probably be increased by surrounding them with low-loss dielectrics, but as the dimensions of the dielectric must greatly exceed those of the aerial system the increase could be achieved more easily by enlarging the aerial system to make full use of the space which would be occupied by the dielectric.

621.396.671 **3352**

Some Methods for Determining the Power Gain of Microwave Aerials.—J. D. Lawson. (*J. Instn elect. Engrs*, Part III, July 1948, Vol. 95, No. 36, pp. 205–209.) Four methods are discussed and their limitations and advantages are indicated. Two require no knowledge of the aerial geometry or polar diagram. The other two require a knowledge of the field across the aerial aperture and can only readily be applied to horns of rectangular cross-section, and even then approximations are necessary. A method for comparing aerials with a standard is also described.

621.396.671 **3353**

Parasitic Beam Patterns.—D. C. Cleckner. (*CQ*, July 1948, Vol. 4, No. 7, pp. 25–29.) Radiation patterns for 3- and 4-element 10-m aerial arrays are obtained from measurements on 1 : 100 scale models, using a wavelength of 10 cm. Front-to-back ratios of over 30 db are possible. Tuning for maximum forward gain will give a front-to-back ratio of about 20 db. This ratio is in general less for a 4-element than for a 3-element array, through the forward pattern is somewhat sharper. See also 2011 of 1947.

621.396.674 **3354**

Properties of Loop Aerials.—F. Horner. (*Wireless Engr*, Aug. 1948, Vol. 25, No. 299, pp. 254–259.) Non-uniform current distribution in a loop occurs unless the wavelength of excitation is much greater than the perimeter of the loop. Such distribution results in a non-uniform field around the loop ; this field may be represented as that from a uniform-current loop, which is a true magnetic dipole, plus a component from an electric dipole, suitably located relative to the loop and suitably excited. Similarly the field from a compound loop comprising two coplanar, non-uniform loops excited in parallel can be considered as due to that from a uniform loop plus components from two electric dipoles. The appropriate location and excitation of such effective dipoles are discussed for circular and rectangular loops of simple and compound types. The radiation resistance of such loops differs greatly from the value calculated on the assumption of uniform loop-current distribution.

621.392.029.64 + 621.396.61.029.64 **3355**

Microwave Transmission Design Data. [Book Review]—Moreno. (*See* 3545.)

621.392.029.64 (083.72) **3356**

British Standard 204 : 1943. Supplement No. 1, Glossary of Terms used in Waveguide Technique. [Book Notice]—British Standards Institution, London, 1948, 2s. (*Brit. Stand. Instn Mon. Inform. Sheet*, May 1948, p. 1.)

CIRCUITS AND CIRCUIT ELEMENTS

621.3.012.2 : 621.392.5 **3357**

Circle Diagrams of Impedance or Admittance for Four-Terminal Networks.—J. Rybner. (*J. Instn elect. Engrs*, Part III, July 1948, Vol. 95, No. 36, pp. 243–252 ; summary, *ibid.*, Part I, June 1948, Vol. 95, No. 90, p. 280.) A general theory is given which applies to both dissipative and asymmetrical networks, transmission-line diagrams being considered as special cases. The theory is based on the concept of the iterative impedances and the iterative transfer constant of the 4-terminal network, and leads to circle diagrams with the iterative impedances or admittances as double points. Such diagrams are actually graphical representations of the complex hyperbolic tangent function. For non-dissipative networks, special forms of the diagrams correspond to the cut-off frequency, the stop band or the pass band. These diagrams are studied by means of projective geometry. Inversion of the ordinary circle diagram leads to the Smith diagram, which is described both for real and complex iterative impedances. For a transmission line of length $< \lambda/4$ the error resulting from considering the characteristic impedances as purely resistive is of the same order of magnitude as that which would result from neglecting the damping along the line.

621.3.076.12 : 621.385.1 : 621.396.822 **3358**

Methods of Compensating the Various Actions of the Shot Effect in Valves and Connected Circuits.—M. J. O. Strutt & A. van der Ziel. (*Physica, 's Grav.*, Jan. 1941, Vol. 8, No. 1, pp. 1–22. In German, with English summary.) Spontaneous fluctuations in electrical circuits may, under certain specified assumptions, be considered as single-wave alternating currents and voltages. The different kinds of such fluctuations are discussed and methods for their suppression are proposed which all involve a special type of feedback. The compensating circuits are analysed with special reference to the signal/noise ratio ; in some circuits the signal/noise ratio may not be increased, though the fluctuations themselves are greatly reduced in some parts of the circuits. An exact analysis of one circuit is given in an appendix, showing the order of magnitude of the terms neglected in the previous approximations.

621.314.3† **3359**

The Theory of Magnetic Amplifiers and Some Recent Developments.—E. H. Frost Smith. (*J. sci. Instrum.*, Aug. 1948, Vol. 25, No. 8, pp. 268–272.) Defects of these amplifiers, such as nonlinear amplification and long time-constant, are explained. Performance may be materially improved by injecting into the core a constant biasing flux from permanent magnets.

621.314.5 + 621.396.622] : 621.385.2 **3360**

The Diode as Converter and as Detector.—J. Haantjes & B. D. H. Tellegen. (*Philips Res. Rep.*, Dec. 1947, Vol. 2, No. 6, pp. 401–419.) The current through a diode, to which a small extra voltage v is applied in addition to an a.c. and a d.c. voltage, can be developed in a series of powers of v with Fourier-series coefficients. The magnitude of these coefficients is calculated for a diode that has a linear characteristic in the pass direction. Using only the terms of the power series linear in v, quadripole equations and equivalent circuits can be set up for the diode as converter and as detector. From these equivalent circuits various properties and quantities can be deduced. The fluctuations of the diode as converter can also be represented with the help of the equivalent circuit. For both conversion and detection the diode should have a small internal resistance.

621.316.86 : 546.281.26 **3361**

Silicon-Carbide Non-Ohmic Resistors.—F. Ashworth, W. Needham & R. W. Sillars. (*J. Instn elect. Engrs*, Part I, June 1948, Vol. 95, No. 90, pp. 244–246.) Discussion on 141 of 1947.

621.316.86 : 621.396.813 **3362**

Presence of Odd Harmonics in Alternating Current traversing Certain Nonmetallic Resistors.—P. Sevin. (*C. R. Acad. Sci., Paris*, 19th July 1948, Vol. 227, No. 3, pp. 183–185.) Measurements of the distortion of a sinusoidal 1 000-c/s current in passage through homogeneous resistor rods of various values showed the presence of an appreciable third harmonic, in some cases as high as 0.85%. For $\frac{1}{4}$-W resistors having a steatite body with a thin conducting coating, distortion is difficult to measure and the third harmonic is in all cases $<0.1\%$. It thus appears that the resistors commonly used in radio technique may produce appreciable distortion. The d.c. resistance of these resistors diminishes when the applied voltage is increased ; this diminution is greater for the homogeneous type of resistor than for the coated-steatite type.

621.385.1 **3363**

Applications and Mounting Details of Rimlock and Mazda-Medium Valves.—Giniaux. (*See* 3555.)

621.392 **3364**

On some Properties of Electrical Networks.—W. Nijenhuis & F. L. Stumpers. (*Physica, 's Grav.*, Feb. 1941, Vol. 8, No. 2, pp. 289–307. In English, with German summary.) The relations between the real or imaginary part of an impedance function, or their logarithms, and the function itself, are discussed, with particular reference to transfer impedances. These relations enable a constant-modulus type of network and a constant-phase type to be distinguished. The design of such networks is considered and some general phase characteristics of driving-point and transfer functions are described.

621.392 : 518.61 **3365**

Network Analysis by the Chain-Relaxation Method.—L. Tasny-Tschiassny. (*J. Instn elect. Engrs*, Part III, May 1948, Vol. 95, No. 35, pp. 177–182 ; summary, *ibid.*, Part I, Aug. 1948, Vol. 95, No. 92, pp. 360–361.) A certain number of branch currents are selected and considered as unknowns to which arbitrary values are assigned. All other branch currents, node potentials, generator voltages and currents, are expressed in terms of the selected branch currents. Additional ' residual ' external node currents are provided in order to make the resulting voltage and current distribution physically possible. The resulting simultaneous linear equations for the initially selected branch currents are solved. The special technique is based on the superposition theorem, obviates unnecessary repetition of algebraic symbols and reduces the possibility of errors. The method leads, in general, to simultaneous equations with a smaller number of unknowns than the usual methods of network analysis ; in many cases only two unknowns are required.

621.392 : 621.317.715 **3366**

The Moving Coil Galvanometer as a Circuit Element.—N. F. Astbury. (*Proc. phys. Soc.*, 1st June 1948, Vol. 60, No. 342, pp. 590–596. Discussion, pp. 596–597.) " An account is given of a simplified calculus applicable to a moving-coil galvanometer in which use is made of the concept of motional impedance. The fundamental galvanometer equations are presented in a novel and very simple form. Examples of the use of the formulae are given, notably with reference to the ultimate ' noise level ' of a galvanometer."

621.392.5 **3367**

Theoretical Analysis of the Mercury Delay Line.—H. J. McSkimin. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, pp. 418–424.) A formula for the pressure distribution in the line is derived. Many waves having slightly different phase velocities can exist ; under certain circumstances these waves may interfere with each other and produce distortion. The voltage developed by the piezoelectric pickup crystal and the distortion that could be caused by carrier p.m. are also considered.

621.396.611 + 621.392.029.64 **3368**

A Method for Calculating the Excitation of Waveguides, Surface and Cavity Resonators.—Ya. N. Fel'd. (*Zh. tekh. Fiz.*, Dec. 1947, Vol. 17, No. 12, pp. 1471–1482. In Russian.)

621.396.611 **3369**

On the Frequency Stability of Certain Resonators.—K. F. Niessen. (*Physica, 's Grav.*, Dec. 1941, Vol. 8, No. 10, pp. 1077–1093. In German.) The variations of the e.m. fundamental natural frequency of a hollow metal cube and of a hollow metal sphere are calculated (*a*) for constant length in one direction, with equal reductions in the other two directions, and (*b*) for an increase in one direction with equal decreases in the other two directions such that the total surface area remains constant. In case (*a*) the frequency variation for the cube is 8 times that for the sphere, but in case (*b*) the variation for the sphere is 3.6 times that for the cube. See also 3208–3210 of 1946.

621.396.611.1 **3370**

A New Approach to Tunable Resonant Circuits for the 300- to 3 000-Mc/s Frequency Range.—F. C. Isely. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1948, Vol. 36, No. 8, pp. 1017–1022.) Discussion of the use of distributed constants and of discontinuities, in lines of fixed length. The advantages and disadvantages of various types of such circuits are discussed, with particular reference to those proposed by Karplus (3260 of 1945), Everett (2520 of 1946) and Huggins (330 of February and 643 and 644 of March).

621.396.611.1 **3371**

Rieke Diagrams for Oscillator Design.—L. S. Schwartz. (*Tele-Tech*, June 1948, Vol. 7, No. 6, pp. 33–36..65.) If changes in power output and frequency of an oscillator, corresponding to load changes, are plotted on a Smith impedance diagram, contours of constant frequency and output can be drawn [see Radiation Laboratory Report 62-2, 24th Aug. 1942 (Rieke & Evans)]. Such diagrams are useful for analysis of oscillator performance and assist materially in determining the optimum coupling. Apparatus and methods for obtaining the data necessary for the construction of these diagrams for microwave oscillators are described ; examples are discussed.

621.396.611.3 **3372**

Cathode-Coupled Negative-Resistance Circuit.—P. G. Sulzer. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1948, Vol. 36, No. 8, pp. 1034–1039.) A complete investigation at l.f., m.f. and h.f. of a circuit discussed by Sziklai & Schroeder (3811 of 1945), Pullen (2507 of 1946) and Crosby (2157 of 1946). The effects of supply voltage variations are considered. The more common types of dual triode can develop a negative resistance of the order of 1 000 Ω and in this circuit they can be used as oscillators even at v.h.f. It is assumed that amplitudes are sufficiently small to permit the use of linear valve parameters ; this may not be true unless some means of amplitude control is provided.

621.396.615 **3373**

Oscillator Circuits for Wide-Range Tuning.—R. J. Ballantine & E. G. James. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 14, pp. 596–602 ; summary, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 114.) Triodes of the disk-seal type are briefly described and a full account is given of various types of external circuit to cover frequency ranges between 300 and 3 750 Mc/s. Coaxial-line common-grid circuits are described ; a wide overall frequency range may be covered by operation in different modes. Mechanical details of sliding-contact bridges are given and internal and external capacitive feedback is discussed. Performance data are included for the CV90 and CV273 valves. Non-contact tuning circuits are also considered, including the butterfly circuit and its derivatives and a cylindrical resonator. Practical designs of symmetrical non-contact circuits are given, with performance data.

621.396.615 **3374**

High-Stability LC Oscillator.—T. Roddam. (*Wireless World*, Aug. 1948, Vol. 54, No. 8, pp. 286–288.) The design of a bridge-stabilized oscillator is described, the performance of which does not depend on the nonlinearity of the valve characteristics. The selective feedback network uses a 4.5-V tungsten-filament lamp and a series-resonant LC circuit in opposite arms of a bridge network to maintain the oscillations at a chosen level. The short-period stability is within about 1 part in 10^5.

621.396.645 **3375**

Distributed Amplification.—E. L. Ginzton, W. R. Hewlett, J. H. Jasberg & J. D. Noe. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1948, Vol. 36, No. 8, pp. 956–969.) I.R.E. 1948 National Convention paper. By an appropriate distribution of ordinary valves along artificial transmission lines, amplification can be obtained over much greater bandwidths than those possible with ordinary circuits. The concept of 'maximum bandwidth-gain product' does not apply to such 'distributed' amplifiers, for which the h.f. limit appears to be determined by grid-loading effects. Band-pass amplifiers, and low-pass amplifiers with uniform frequency response between zero and several hundred megacycles per second, can thus be designed, using commercially available valves; practical amplifiers have been built which have verified the theoretical predictions. Experimental work will be described later: theoretical discussion is here included of (*a*) the effect of improper termination of transmission lines, (*b*) methods for controlling the frequency response and phase characteristic, (*c*) the design which provides the required gain with the minimum number of valves, (*d*) h.f. limitations, (*e*) noise-factor evaluation.

621.396.645.029.3 **3376**

An Amplifier for Very Low Frequencies.—S. P. Pivovarov. (*Zh. tekh. Fiz.*, June 1948, Vol. 18, No. 6, pp. 799–804. In Russian.) A 6-stage amplifier, with high input impedance, passing rectangular impulses at frequencies from 5 to 10 000 c/s. The gain is 150 000.

621.396.645.371 **3377**

Improvements in Negative-Feedback Amplifiers.—J. Polonsky. (*Ann. Radioélect.*, July 1948, Vol. 3, No. 13, pp. 240–251.) A local reaction path is provided in one part of the amplifier and gives positive feedback within the pass band and negative outside the band. This increases the signal/noise ratio considerably (20–30 db) without affecting the amplifier stability. The gain is not appreciably altered, but linear and nonlinear distortion are both reduced. The theoretical conclusions are confirmed by tests carried out on a 1-kW and a 20-kW broadcasting transmitter. Other applications are suggested.

621.396.662.21 **3378**

Two Simple Methods of Detecting Short-Circuited Turns in Coils.—E. B. Brown. (*J. sci. Instrum.*, Aug. 1948, Vol. 25, No. 8, p. 282.) In both methods the coil to be tested is threaded on the core of a transformer with an open magnetic circuit. The secondary voltage of this transformer has previously been balanced against that of an exactly similar transformer. If the coil has short-circuited turns, a current flows in the detector. The lay-out of apparatus is shown in detail.

621.396.662.21 **3379**

Short-Circuited Turns.—K. R. Sturley. (*Wireless Engr*, Aug. 1948, Vol. 25, No. 299, pp. 240–245.) The common practice of short-circuiting turns to alter the inductance of a coil at r.f. is very unsuitable at audio and power frequencies. This is due not to any fundamental differences between r.f. and a.f. short-circuits but to differences in coupling coefficients, Q-factors and inductance ratios of the main coil to the short-circuited section.

621.396.665 : 534.79 : 534.85/.86 **3380**

Loudness Control for Reproducing Systems.—D. C. Bomberger. (*Audio Engng, N.Y.*, May 1948, Vol. 32, No. 5, pp. 11–12..38.) A switch inserts up to 10 identical attenuator sections; these are designed on an image-impedance basis and have gain/frequency characteristics which compensate for the intensity/loudness relation of the human ear. A practical design is given, with component values and measured characteristics.

621.392 + 621.396.645.37 **3381**

Network Analysis and Feedback Amplifier Design. [Book Review]—H. W. Bode. D. Van Nostrand, New York, & Macmillan, London, 551 pp., 42s. (*Wireless Engr*, Aug. 1948, Vol. 25, No. 299, p. 268.) "This book will undoubtedly become a standard textbook." It is for the specialist, not for the occasional designer. It is well packed with solid theory. See also 583 and 2169 of 1946.

GENERAL PHYSICS

53.081 + 621.3.081 **3382**

Universal Conversion Table of Electrical Units.—Kaufmann. (*See* 3451.)

534.133 **3383**

Consideration of a Linear Non-Homogeneity of the Applied Alternating Field in the Excitation of a Quartz Bar.—K. F. Niessen. (*Physica, 's Grav.*, July 1941, Vol. 8, No. 7, pp. 695–702. In German.) The odd harmonics of a quartz bar can be produced by the application of a homogeneous alternating field of suitable frequency. The resonance curves in the neighbourhood of these harmonic frequencies have been calculated by von Laue. The possibility of exciting the even harmonics by applying a non-homogeneous alternating field is examined and resonance curves near these new frequencies are calculated. An electrode system suitable for excitation of the second harmonic is described briefly.

534.21 **3384**

Thickness-Shear Vibrations of Thin Anisotropic Plates.—G. Hok. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, pp. 406–417.)

536.48 **3385**

Low Temperature and Some of Its Effects upon the Behavior of Matter.—S. C. Collins. (*Science*, 2nd April 1948, Vol. 107, No. 2779, pp. 327–333.) Discussion of: (*a*) progress in low-temperature research, (*b*) industrial methods of producing low temperatures, (*c*) the effect of magnetic fields on superconducting substances, (*d*) various theories concerning the behaviour of He I, He II, and the isotope He_3. See also 3847 of 1947 (Mendoza).

537.315.6 : 621.315.59 **3386**

Use of Electron Mirror to Display the Potential Distribution on Metallic and Semiconductor Surfaces.—R. Orthuber. (*Z. angew. Phys.*, March 1948, Vol. 1, No. 2, pp. 79–89.) Description of a method which has applications in infra-red technique.

537.52 **3387**

Dynamic Probe Characteristics.—T. A. Anderson. (*Phil. Mag.*, March 1947, Vol. 38, No. 278, pp. 179–185.) Discussion of errors occasioned by using the static characteristics of probes in gas discharge investigations. Apparatus for obtaining the dynamic characteristics is described and preliminary results are given.

537.521.7 **3388**

Certain Aspects of the Mechanism of Spark Discharge.—L. B. Loeb. (*Proc. phys. Soc.*, 1st June 1948, Vol. 60, No. 342, pp. 561–573.)

537.523 : 538.67 : 621.316.98 **3389**

Lightning Arrester Discharge Currents.—R. C. Cuffe. (*Nature, Lond.*, 5th June 1948, Vol. 161, No. 4101, pp. 885–886.) The earth lead in each 38-kV single-phase arrester was equipped with a pair of magnetic links. Results indicate that these had not been magnetized by a unidirectional current discharge. The magnitude of the current reversal is evaluated and various possible explanations are given.

537.525.029.64 **3390**

Breakdown of a Gas at Microwave Frequencies.—M. A. Herlin & S. C. Brown. (*Phys. Rev.*, 1st Aug. 1948, Vol. 74, No. 3, pp. 291–296.) The criterion for breakdown of a low-pressure gas at microwave frequencies is that ionization by collision of electrons with neutral gas molecules replaces loss by diffusion to the walls of the discharge tube. A new ionization coefficient is introduced appropriate to the h.f. discharge condition and its relation to the d.c. Townsend coefficient is explained. The energy transfer from field to electrons, for a given ratio of field strength to pressure, is most efficient when the pressure is high enough or the frequency low enough to result in many collisions, in each cycle, between electrons and gas molecules. When the pressure is lower or the frequency is higher, energy transfer is lower because the electrons have an out-of-phase component of motion.

537.533 **3391**

Thermionic Emission from Metals Covered by a Thin Semiconducting Layer.—S. I. Pekar & O. F. Tomasevich. (*Zh. tekh. Fiz.*, Dec. 1947, Vol. 17, No. 12, pp. 1393–1396. In Russian.) Formulae are derived for determining the thermionic current. They are consistent with Richardson's formula (16) in which use is made of the work function of the metal and not of the semiconductor.

537.533.8 **3392**

Secondary Emission : Parts 1 & 2.—L. R. Koller. (*Gen. elect. Rev.*, April & June 1948, Vol. 51, Nos. 4 & 6, pp. 33–40 & 50–52.) Discussion of the various factors governing secondary emission, with a table giving the maximum secondary yield and corresponding voltage for many metals, and a short account of various applications.

537.58 : 621.385.1 **3393**

Space Charge Current Theory and the Mechanical Impulse of the Electrons.—P. Selényi. (*Physica, 's Grav.*, Aug. 1941, Vol. 8, No. 8, pp. 885–902. In English, with German summary.) It is shown that the electrodes of a valve are subjected to pressures due to the impulse of the electrons. The value of the field strength at the surface of the cathode can be deduced from the mechanical equilibrium conditions, in accordance with the kinetic theory. If the electrodes of a valve are capable of movement, the inertia of the electrons can be demonstrated in many ways. A method of measurement of the pressure exerted by an electron beam is described. A preliminary report of this work was noted in 1804 of 1941.

538.12 **3394**

On Magnetic Field Theories.—G. H. Livens. (*Phil. Mag.*, July 1947, Vol. 38, No. 282, pp. 453–479.) The field theory of Hertz, based on an assumed linear law of induction, is criticized. It is suggested that no theory has proved superior to the original Poisson-Kelvin theory which assumes nothing but a polar constitution for all magnetism. The work of Cohn and Guggenheim in developing the Hertz theory is discussed and a number of inconsistencies are pointed out. Arguments are given for the adoption of B as the fundamental field vector, and the consequent mathematical modifications of the Poisson-Kelvin theory are indicated.

538.221 **3395**

Ferromagnetism.—E. C. Stoner. (*Rep. Progr. Phys.*, 1946/1947, Vol. 11, pp. 43–109. Bibliography, pp. 110–112.) The first part of this review summarizes the development of the basic ideas up to about 1934. The remainder is devoted to a survey of later theoretical and experimental work on the fundamental problem of intrinsic magnetization and its changes with field and temperature. A third part to be published next year will deal with magnetization curves.

538.551.21.029.63 **3396**

On the Significance of the Terms Current, Potential, Resistance and Quadripole for Decimetre Waves.—H. H. Meinke. (*Z. angew. Phys.*, March 1948, Vol. 1, No. 2, pp. 90–98.) A quantitative treatment of v.h.f. devices is only considered possible if the terms current, potential and resistance are critically analysed and re-defined with the help of so-called induction-free and displacement-current-free surfaces. The simplest examples of such surfaces are the planes normal to homogeneous conductors. The general properties of these surfaces are discussed and the case of non-homogeneous concentric conductors, with surfaces of greater complexity, is considered specially.

538.569.4.029.64 : 546.171.1 **3397**

Collision Broadening of the Inversion Spectrum of Ammonia : Part 3 — The Collision Cross-Sections for Self-Broadening and for Mixtures with Non-Polar Gases.—B. Bleaney & R. P. Penrose. (*Proc. phys. Soc.*, 1st June 1948, Vol. 60, No. 342, pp. 540–549.) For pure NH_3 the width variation of lines near 1 cm^{-1} is consistent with a simple dipole-dipole interaction for the collision mechanism. The collision diameters for mixtures of NH_3 with non-polar gases are about the same as those obtained from the kinetic theory, whereas in pure NH_3 they are 2 to 4 times greater. Part 2 : 1916 of July.

538.569.4.029.64 : 546.21 **3398**

Atmospheric Absorption of Microwaves.—H. R. L. Lamont. (*Phys. Rev.*, 1st Aug. 1948, Vol. 74, No. 3, p. 353.) The absorption of e.m. radiation was measured for λ between 6.34 mm and 4.48 mm, over distances ranging from 0.12 km to 2.2 km. The mean corrected values for the attenuation were found to be in good agreement with Van Vleck's theoretical curve (3098 of 1947).

549.211 : 537.533.9 : 539.16.08 **3399**

Remarks on Diamond Crystal Counters.—K. Lonsdale. (*Phys. Rev.*, 15th June 1948, Vol. 73, No. 12, p. 1467.) 'Type-I' diamonds which are opaque to ultra-violet radiation are said to be nearly perfect and neither of mosaic structure nor laminated. The 'Type-II' diamonds which make the best γ-ray counters, however, are apparently laminated. See also 2575 of September and 2757 of October.

549.514.51 : 535.417 **3400**

Application of Multiple-Beam Interferometry to the Study of Oscillating Quartz Crystals.—S. Tolansky & W. Bardsley. (*Nature, Lond.*, 12th June 1948, Vol. 161, No. 4102, p. 925.) A method giving sharp fringes which become extremely narrow along nodal lines. Similar methods were used by Dye (*Rep. Nat. phys. Lab.*, 1928, pp. 113–115).

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.5 : 551.510.535 **3401**

The Theory of Meteor Ionization.—N. Herlofson. (*Rep. Progr. Phys.*, 1946/1947, Vol. 11, pp. 444–453. Bibliography, pp. 453–454.) Discussion of the salient points of the principal theories.

523.5 : 551.510.535 **3402**

Meteoric Ionization and Ionospheric Abnormalities.—A. C. B. Lovell. (*Rep. Progr. Phys.*, 1946/1947, Vol. 11, pp. 415–442. Bibliography, pp. 442–444.) Part 1 summarizes the history of the correlation of irregularities in E-region behaviour with meteoric activity. Part 2 gives a more detailed review of contemporary work on transient echoes from meteors. This includes the determination of the characteristics of the meteor showers themselves and also of the clouds of ionization from which echoes are received.

523.53 : 621.396.82 **3403**

Meteor Whistles.—H. V. Griffiths, S. E. Martingell & R. W. Bayliff. (*Nature, Lond.*, 27th March 1948, Vol. 161, No. 4091, pp. 478–479.) A summary of the results of measurements taken over a long period at the B.B.C. receiving station at Tatsfield. Generally the pitch of the whistle decreases to zero from about 2 kc/s, but for 1–2% of the total number observed the pitch increases again up to 2 kc/s. The Appleton-Naismith theory for the change in pitch (3874 of 1947) would explain these ' doublet ' whistles.

523.7 : 538.12 **3404**

On the Sun's General Magnetic Field.—T. G. Cowling. (*Mon. Not. R. astr. Soc.*, 1945, Vol. 105, No. 3, pp. 166–174.) Discussion of various theories, none of which seems entirely adequate ; considerations are advanced which may make clearer the conditions which an adequate theory must satisfy.

523.746 **3405**

Magneto-Hydrodynamic Waves and Sunspots : Parts 1 & 2.—H. Alfvén. (*Mon. Not. R. astr. Soc.*, 1945, Vol. 105, Nos. 1 & 6, pp. 3–16 & 382–394.) A new theory of sunspots is advanced, according to which the magnetic field of the spot is the primary phenomenon. The other properties of a spot (e.g. the low temperature) are found to be due to the effect of the magnetic field on the solar atmosphere. The field is supposed to originate near the sun's centre and to be transmitted outwards along the magnetic lines of force of the sun's general magnetic field in the form of a new type of wave, called the magneto-hydrodynamic wave. The progression of sunspot zones is discussed and a progression curve is derived from sunspot observations. Comparison with theory enables conclusions to be drawn regarding the sun's general magnetic field.

Part 2 deals with the shape and orientation of the magneto-hydrodynamic whirl rings. Such rings, created in the solar core, proceed outwards along the magnetic lines of force ; when a whirl ring intersects the solar surface, a bipolar spot is produced. From the life history of a bipolar spot the shape of the whirl ring when in the solar core can be found. The properties of whirls are considered and their propagation in the sun is discussed. The sun cannot be divided into a convective and a non-convective part, as suggested in some solar models, since convection in one part of the sun must cause magneto-hydrodynamic waves which give rise to convection in other parts also. Part 3 : 3104 of November.

538.12 : 521.15 **3406**

Comments on the Theories Interpreting the Magnetism of Celestial Bodies.—M. Forró. (*Phys. Rev.*, 15th July 1948, Vol. 74, No. 2, pp. 218–219.) In the theory of Babcock (3891 of 1947) and Blackett (3112 of 1947), the consideration that with every mass an electric charge should be associated, must also involve the converse that with every moving (rotating) charge a momentum must be associated. This second inference can be shown to be untrue by a simple laboratory experiment. The difficulty in interpreting Wilson's relation, $e \sim M(G)^{\frac{1}{2}}$, is not so much in determining a field theory to account for the proportionality between mass and charge, but in explaining the irreversibility of this relationship. Barnóthy's theory (3407 below) will account for Wilson's formula and its irreversibility, but cannot explain the large static potentials arising and also give the correct values of magnetic momenta.

538.12 : 521.15 : 539.15 **3407**

Elementary Particles and the Geomagnetic Field.—T. G. Cowling. (*Nature, Lond.*, 13th Dec. 1947, Vol. 160, No. 4076, p. 847.) Short account of a theory proposed by J. Barnóthy (Hungarian Institute for Meteorology and Terrestrial Magnetism, Papers on Terrestrial Magnetism, No. 2, 1947), which explains the elementary particles, such as protons and electrons, in terms of serial universes, each enclosed in one of higher order. Quantitative application of the theory leads to values of fundamental constants in good agreement with experimental values. Barnóthy claims that the theory explains the proportionality between magnetic moment and angular momentum of sun and earth. He asserts that protons and neutrons possess besides their real mass an imaginary mass, 643 times the electron-mass, which behaves like an electric charge. The rotation of such a charge would produce terrestrial and solar magnetic fields of the observed order of magnitude. Such a charge would, however, produce a large e.s. field, which Barnóthy declines to consider for the present.

550.384 **3408**

Audio-Frequency Magnetic Fluctuations.—H. F. Willis. (*Nature, Lond.*, 5th June 1948, Vol. 161, No. 4101, pp. 887–888.) Magnetic fluctuations at frequencies in the range 5–1 000 c/s have been observed at various sites remote from man-made sources of electrical disturbance. These fluctuations are considered to be of natural origin, possibly arising from distant current movements in the atmosphere. See also 1628 of June (Menzel & Salisbury).

550.384.3 **3409**

The Main Geomagnetic Field.—S. Chapman. (*Nature, Lond.*, 27th March 1948, Vol. 161, No. 4091, pp. 462–464.) A geophysical discussion held at the Royal Astronomical Society. A new theory suggested that the secular magnetic variation may be due to an electric current, produced by e.m. induction, flowing in the mass of an eddy near the surface of the earth's liquid core. Measurements of the magnetic anomalies in tholeiite dykes in Northern England, and the results of a survey over Eire of the vertical magnetic force (V), showing further anomalies, were also discussed. Some results of measurements of the variation with depth below ground of H and V were given, and discussed in relation to Blackett's theory noted in 3112 of 1947.

551.510.535 : 621.396.11 **3410**

On the Localization of the Sporadic-E Ionized Region of the Upper Atmosphere.—P. Revirieux : P. Lejay. (*C. R. Acad. Sci., Paris*, 5th July 1948, Vol. 227, No. 1, pp. 79–81.) In June 1948, good 2-way low-power communication at frequencies near 60 Mc/s was maintained for several hours between amateur stations near Paris and others in (*a*) Czechoslovakia (27th June), (*b*) South Norway (28th June), (*c*) South Sweden

(29th June). Such long-distance communication could not be established with any other stations during the periods concerned. On 7th June long-distance communication in the 60-Mc/s band could only be established with Algeria. These results indicate the existence of sharply localized ionization zones which move slowly and are situated roughly midway between Paris and the places with which radio contact on these frequencies is possible. Movement of such an ionization zone was noted on 4th June between 1630 and 2000 G.M.T., when communication was carried out successively between Paris and (*a*) northern countries, particularly Sweden, (*b*) Denmark, (*c*) Czechoslovakia, (*d*) Switzerland and Italy, (*e*) French stations near the Mediterranean, (*f*) Algeria.

Lejay states that particularly strong sporadic-E was recorded at Bagneux in two periods which coincide precisely with those noted above. The sporadic-E upper frequency limits, on the afternoon of 4th June and the morning of 5th June, exceeded the highest frequency (13 Mc/s) available for the Bagneux transmitter. Between 24th and 29th June the upper limits were not so high, but many multiple echoes were noted, particularly on 26th and 27th June.

The amateur observations supply valuable information as to the situation and extent of a phenomenon whose cause is at present uncertain; such information is not given by vertical soundings of the ionosphere. See also 3117 of November (Ferrell).

551.593.9 **3411**

Excitation Processes of the Night Sky Spectrum.—S. N. Ghosh. (*Proc. nat. Inst. Sci. India*, 29th Dec. 1943, Vol. 9, No. 2, pp. 301–310.) Discussion of various features of Mitra's hypothesis (1109 of 1944).

551.594.6 : 621.396.821 **3412**

Variation, with Wavelength, of the Range of Atmospherics and of the Impulsive Flux per Metre corresponding to the Threshold of Operation of Receiver-Recorders of the Mean Level.—Carbenay. (*See* 3504.)

LOCATION AND AIDS TO NAVIGATION

621.396.93 **3413**

The Measurement of Errors in Radiogoniometers at High and Very High Frequencies.—B. G. Pressey. (*J. Instn elect. Engrs*, Part III, July 1948, Vol. 95, No. 36, pp. 221–228; summary, *ibid.*, Part I, June 1948, Vol. 95, No. 90, p. 279.) Description of three methods of error measurement which all involve the application of two signal-frequency voltages of known ratio r, one to each field coil of the goniometer. The goniometer reading for minimum search-coil output is compared with the true angle $\tan^{-1}r$. The accuracy of the methods is discussed and details of the construction and calibration of the apparatus are given. Typical error measurements made on various goniometers are shown.

621.396.93 **3414**

Radiogoniometers for High- and Very-High-Frequency Direction-Finding.—B. G. Pressey. (*J. Instn elect. Engrs*, Part III, July 1948, Vol. 95, No. 36, pp. 210–220; summary, *ibid.*, Part I, June 1948, Vol. 95, No. 90, p. 278.) General design principles are discussed; the important factors are the coupling law, the electrical symmetry of the field coils, and the coupling factor. A distributed search-coil winding for reducing the coupling error at m.f. and h.f. is described and its application to four h.f. instruments is considered. At v.h.f. a compound-wound search coil is used; its windings are in two sections whose planes are set at an angle θ. The coupling error depends upon θ and the field configuration. A v.h.f. instrument based on these principles is described. The operation of the inductive goniometer as a phase shifter is analysed.

621.396.932 : 621.396.96 **3415**

Radar Navigational Aid for Liverpool.—(*Engineering, Lond.*, 4th June 1948, Vol. 165, No. 4297, p. 534.) Tests with experimental equipment showed that a discrimination better than 1° in bearing and about 40 yards in range was necessary to meet requirements for the long and narrow approach channel. The permanent equipment will include a 15-ft parabolic aerial for λ 3 cm, rotating at 12 r.p.m., and 6 plan position indicators mounted in a U-shaped console. The first of these gives a small-scale picture of the whole channel up to a distance of either 13 or 20 miles; 4 give a larger-scale composite picture and the sixth enables any area within 20 miles, not shown on the composite picture, to be scanned. Information will be passed to pilots or masters of vessels by R/T. For other accounts see *Wireless World*, Sept. 1948, Vol. 54, No. 9, pp. 317–320 and *Engineer, Lond.*, 6th Aug. 1948, Vol. 186, No. 4828, pp. 130–132.

621.396.933 **3416**

Surveillance Radar Deficiencies and how they can be Overcome.—J. W. Leas. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1948, Vol. 36, No. 8, pp. 1015–1017.) Surveillance or primary radar can be used by itself only as a monitor in civil operations. Its defects could be largely overcome, but only by major design alterations of existing equipment. Primary radar assisted by cooperating airborne transponders, however, can become a primary aid in traffic control.

621.396.96 : 621.396.65.029.64 **3417**

The Transmission of Radiolocation Displays by means of Microwave Linkage Systems.—Germany & Lawson. (*See* 3519.)

621.396.933.2 **3418**

Radar Beacons. [Book Review]—A. Roberts (Ed.). McGraw-Hill, New York, 1947, 474 pp., $6.00. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1948, Vol. 36, No. 8, p. 1010.) No. 3 of the M.I.T. Radiation Laboratory series reviewing war-time work. "The theory and practice underlying the use of radar beacons is thoroughly covered." For another review see *Nature, Lond.*, 23rd Oct. 1948, Vol. 162, No. 4121, pp. 633–635.

621.396.96 **3419**

Principles of Radar. [Book Review]—D. Taylor & C. H. Westcott. Cambridge University Press, London, 141 pp., 12s. 6d. (*Wireless Engr*, Aug. 1948, Vol. 25, No. 299, p. 267.) One of the series on 'Modern Radio Technique': others were noted in 350 of February (Huxley) and 1048 of April (Smith). General principles peculiar to radar are stressed; the book is mainly concerned with primary radar involving reflection from the target. The properties of the target are discussed with special reference to absorbing, scattering and echoing areas.

MATERIALS AND SUBSIDIARY TECHNIQUES

535.37 **3420**

The Luminescence of Simple Oxide Phosphors.—R. B. Head. (*Electronic Engng*, July 1948, Vol. 20, No. 245, pp. 219–226.) Discussion of qualitative rather than quantitative experimental data. The phosphors examined are inefficient, and very insensitive to heat treatment and the addition of fluxes, but they provide data from which reliable conclusions can be drawn. Colour diagrams are included. CaO is much the most important source of phosphors and CaO(Ce) gives the shortest afterglow.

535.37 **3421**

The Electron Trap Mechanism of Luminescence in Sulphide and Silicate Phosphors.—G. F. J. Garlick & A. F. Gibson. (*Proc. phys. Soc.*, 1st June 1948, Vol. 60, No. 342, pp. 574–590.)

535.37 **3422**

The Relation between Efficiency and Exciting Intensity for Zinc-Sulphide Phosphors.—H. A. Klasens, W. Ramsden & Chow Quantie. (*J. opt. Soc. Amer.*, Jan. 1948, Vol. 38, No. 1, pp. 60–65.)

535.37 **3423**

The Decay of the Luminescence of Zinc Sulphide Phosphors excited by X Rays.—W. de Groot. (*Physica, 's Grav.*, July 1941, Vol. 8, No. 7, pp. 789–795. In English, with German summary.)

535.37 **3424**

The Absorption Spectra of Zinc Sulphide and Willemite.—J. H. Gisolf, W. de Groot & F. A. Kröger. (*Physica, 's Grav.*, July 1941, Vol. 8, No. 7, pp. 805–809. In English.) A survey of published data.

535.37 : 546.655.3 **3425**

Luminescence of Cerium Compounds.—F. A. Kröger & J. Bakker. (*Physica, 's Grav.*, July 1941, Vol. 8, No. 7, pp. 628–646. In English, with German summary.) Compounds of trivalent Ce, both in the solid state and in solution, have an absorption spectrum made up of several broad overlapping bands. Irradiation in this absorption region causes the emission of a similar set of broad double bands lying partly in the ultraviolet and partly in the short-wave portion of the visible spectrum. The doublet separation of about 1 900 cm^{-1} is in satisfactory agreement with the value of 2 253 cm^{-1} found for the free ion.

535.37 : 621.385.832 : 535.65 **3426**

Spectral Power Distribution of Cathode-Ray Phosphors.—R. M. Bowie & A. E. Martin. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1948, Vol. 36, No. 8, pp. 1023–1029.) Discussion of the principal existing colorimetric methods used for investigating screen materials. Methods for standardizing colorimetric measuring equipment are suggested.

538.213 **3427**

The Determining Factors of Permeability.—J. L. Snoek. (*Physica, 's Grav.*, March 1941, Vol. 8, No. 3, pp. 344–346. In English, with German summary.) The observed magnetic properties of cold-worked Ni-Fe alloys cannot be explained solely by internal strains and crystal anisotropy ; at least one other factor, which is not as yet fully known, must be taken into account. See also 3428 below.

538.213 **3428**

Magnetic Anisotropy Phenomena in Cold-Rolled Nickel-Iron.—G. W. Rathenau & J. L. Snoek. (*Physica, 's Grav.*, June 1941, Vol. 8, No. 6, pp. 555–575. In English, with German summary.) An exhaustive experimental investigation confirming the conclusions in 3427 above.

538.213 : 546.74 **3429**

Metastable States of Nickel Characterized by a High Initial Permeability.—J. L. Snoek & J. F. Fast. (*Nature, Lond.*, 5th June 1948, Vol. 161, No. 4101, p. 887.) For pure, well-annealed Ni, the initial permeability μ_0 is not a unique function of the temperature. The value at room temperature, when obtained from the results at decreasing temperatures, is nearly double that observed after demagnetizing. Temperature agitation alone does not bring about the more stable condition, but small mechanical shocks or demagnetizing treatment are also required.

538.221 **3430**

The Properties of Ferromagnetic Materials in Alternating Fields.—K. M. Polivanov. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, March/April 1948, Vol. 12, No. 2, pp. 98–115. In Russian.) A theoretical discussion of the relationship between the ratio $\dot{E}_0/\dot{H}_0$ on the surface of a sample in an alternating electric or magnetic field, and the following factors : frequency, complex permeability, specific conductivity and one of the linear dimensions. Methods for calculating the performance of a sample are also indicated.

538.221 : 621.314.3† **3431**

Improved Material for Magnetic Amplifiers.—(*Electronics*, Aug. 1948, Vol. 21, No. 8, pp. 128 . . 166.) A coordinated summary of the papers presented at a symposium on magnetic materials held in Washington, D.C., 15th June 1948. Methods of producing materials having substantially rectangular hysteresis loops with a sharp knee are discussed, with special reference to the production of permenorm 5000-Z, an alloy consisting of equal proportions of Ni and Fe, by a process combining cold reduction and annealing. The permenorm is finally rolled to a thickness of 0.001 2 or 0.002 inch and wound into spiral cores. These cores should not have airgaps or be mechanically strained, and the magnetic field must be sensibly uniform over the entire cross-section. Applications of these cores are discussed, namely : (*a*) magnetic amplifiers for industrial control equipment needing little maintenance, and (*b*) saturable reactors for improving the timing of commutation in efficient high-current mechanical rectifiers.

538.23 **3432**

The Influence of Eddy Currents on the Apparent Hysteresis Loop of Ferromagnetic Bars.—J. L. Snoek. (*Physica, 's Grav.*, April 1941, Vol. 8, No. 4, pp. 426–438. In English, with German summary.) If the magnetizing current is varied so rapidly that the magnetization of the interior of a bar lags behind that of the exterior, the measured mean induction differs considerably from that found after a relatively slow variation of the field. With ring-shaped samples this effect does not occur. With bars the measured value of the coercive force may be in error by a factor of 2 or more and the error in the total hysteresis loss may be still larger. The effect explains various inconsistencies and anomalies in measurement results for bars and wires.

549.514.51 **3433**

The Laboratory Growing of Quartz.—D. R. Hale. (*Science*, 16th April 1948, Vol. 107, No. 2781, pp. 393–394.) A report of experimental work carried out by the Brush Development Company.

549.623.5 : 621.315.616 **3434**

Magnetic Susceptibility of Mica.—J. T. Kendall & D. Yeo. (*Nature, Lond.*, 27th March 1948, Vol. 161, No. 4091, pp. 476–477.) The high paramagnetism of synthetic mica prepared by the method of Eitel and Dietzel is due to inclusions of magnetite.

620.193.2 **3435**

Electrical Contacts : The Effect of Atmospheric Corrosion.—U. R. Evans. (*Metal Ind., Lond.*, 2nd July 1948, Vol. 73, No. 1, pp. 10–13.) A discussion of present knowledge and the results of experiments conducted on 'tarnish films'. Two entirely different types of corrosion are possible : (*a*) oxide films produced when the air is not contaminated, and (*b*) corrosion at high humidities in air contaminated by sulphur in various forms. The need for further research is stressed and the conditions which should be observed in practice are indicated. A bibliography of 31 items is included.

621.3.015.5.029.63/.64 : 546.217 **3436**

Experiments on the Electric Strength of Air at Centimetre Wavelengths.—R. Cooper. (*J. Instn elect. Engrs*, Part III, July 1948, Vol. 95, No. 36, p. 312.) Discussion on 750 of March.

621.315.5 : 666.11 **3437**

Electrically Conducting Glasses.—R. L. Green & K. B. Blodgett. (*J. Amer. ceram. Soc.*, 1st April 1948, Vol. 31, No. 4, pp. 89–100.) Glasses containing oxides of Pb, Bi or Sb, or combinations of these, become conducting after several hours' reduction in H. The electronic surface conductivity is both stable and reproducible. The magnitude of the conductivity depends on the nature and amounts of the reducible oxides, the temperature at which reduction takes place, and the electrical influence of the unreduced portions of the glasses.

621.315.59 **3438**

Modulation of Conductance of Thin Films of Semi-Conductors by Surface Charges.—W. Shockley & G. L. Pearson. (*Phys. Rev.*, 15th July 1948, Vol. 74, No. 2, pp. 232–233.)

621.315.59 : 546.289 **3439**

Nature of the Forward Current in Germanium Point Contacts.—W. H. Brattain & J. Bardeen. (*Phys. Rev.*, 15th July 1948, Vol. 74, No. 2, pp. 231–232.)

621.315.612 **3440**

Ceramic Dielectric Materials.—B. H. Marks. (*Electronics*, Aug. 1948, Vol. 21, No. 8, pp. 116–120.)

621.315.612.011.5 **3441**

Properties of Barium-Magnesium Titanate Dielectrics.—G. R. Shelton, A. S. Creamer & E. N. Bunting. (*J. Amer. ceram. Soc.*, 1st July 1948, Vol. 31, No. 7, pp. 205–212.) Continuation of 3551 of 1947. Results of measurements of dielectric constant and power factor reciprocal are tabulated for frequencies of 50–20 000 c/s, together with some measurements at 3 000 Mc/s. The effects of composition, various heat treatments, aging and temperatures in the range −60° C to +85° C are discussed and tabulated.

621.315.616 : 534.213 : 534.321.9 **3442**

Measurement of Ultrasonic Bulk-Wave Propagation in High Polymers.—A. W. Nolle & S. C. Mowry. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, pp. 432–439.) The velocity and attenuation of longitudinal waves of dilatation in solid samples of high polymers are measured at frequencies between 10 and 30 Mc/s by an acoustic pulse technique. Results for various materials and temperatures are discussed.

621.315.616 : 679.5 **3443**

Electrical Properties of Plastics.—A. J. Warner. (*ASTM Bull.*, Aug. 1948, No. 153, pp. 60–64. Discussion, p. 64.) Results are given for the loss factor of polytetrafluorethylene (*a*) at 24° C from 60 c/s to 3 000 Mc/s, (*b*) at 60 c/s, for heat cycles between −30° C and +160° C. The effect of various plasticizers on the h.f. power factor of polyethylene and polytetrafluorethylene at high temperatures is also discussed.

621.385.032.21 : [546.86+546.36 **3444**

Optical and Photoelectrical Properties of Antimony-Caesium Cathodes.—N. D. Morgulis, P. G. Borzyak & R. I. Dyatlovitskaya. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, March/April 1948, Vol. 12, No. 2, pp. 126–143. In Russian.)

666.115 **3445**

A Note on Very Soft Glasses and Some of Their Electrical Applications.—A. E. Dale & J. E. Stanworth. (*J. Soc. Glass Tech.*, June 1948, Vol. 32, No. 146, pp. 147–153.) Preliminary results of the experimental production of 'solder glasses' which bear the same relationship to normal glasses as solder bears to normal metals. (Pb, Zn)-borate glasses appear to be the most promising.

669.71 : 620.193.2 **3446**

Protective Films.—F. A. Champion. (*Metal Ind., Lond.*, 28th May & 4th June 1948, Vol. 72, Nos. 22 & 23, pp. 440–442, 444 & 463–464.) The film of alumina formed on Al and its alloys under corrosive conditions is responsible for the high corrosion resistance of these metals and controls the corrosion/time curve. Results of research on these curves are discussed.

538.221 **3447**

New Developments in Ferromagnetic Materials. [Book Review]—J. L. Snoek. Ebsevier Publishing Co., New York and Amsterdam. British distributors: Cleaver-Hume Press, London, 1947, 136 pp., 13s. 6d. (*Metal Ind., Lond.*, 4th June 1948, Vol. 72, No. 23, p. 465.) Based on work carried out at the Natuurkundig Laboratorium, Eindhoven, Holland, since 1933 and during the last war. In part 2 the dynamics of ferromagnetism are discussed; a new approach is made by the introduction of a time factor, whose influence in various processes is considered. See also *Nature, Lond.*, 1st May 1948, Vol. 161, No. 4096, p. 666.

MATHEMATICS

518.5 **3448**

An Ultrasonic Memory Unit for the EDSAC.—M. V. Wilkes & W. Renwick. (*Electronic Engng*, July 1948, Vol. 20, No. 245, pp. 208–213.) An introductory description of the general principles and mechanical construction of the memory unit of the EDSAC, now being built at the University Mathematical Laboratory, Cambridge, pointing out its advantages over the ENIAC developed in America. Theoretical circuit and block schematic diagrams and photographs are included. A similar type of memory is used in the EDVAC (2828 of 1947).

518.61 : 621.392 **3449**

Network Analysis by the Chain-Relaxation Method.—Tasny-Tschiassny. (*See* 3365.)

517.942.82 (083.5) **3450**

Tabellen zur Laplace-Transformation und Anleitung zum Gebrauch. (Tables for the Laplace Transformation and Introduction to its Use.) [Book Review]—G. Doetsch. Springer, Berlin and Göttingen, 1947, 185 pp. (*Phys. Blätter*, 1948, Vol. 4, No. 3, p. 129.) The book is limited to the classical one-dimensional Laplace transformation. A further work on two- and multi-dimensional transformations, which are important for dealing with systems of partial differential equations, is announced in the preface.

MEASUREMENTS AND TEST GEAR

53.081+621.3.081 **3451**

Universal Conversion Table of Electrical Units.—A. Kaufmann. (*Radio franç.*, July/Aug. 1948, pp. 9–11.) A useful table relating the c.g.s. e.s. and e.m. systems to the practical, Giorgi, and rationalized Giorgi systems of units.

621.3.018.4 (083.74) **3452**

Emission of Standard Frequencies.—(*Phys. Blätter*, 1948, Vol. 4, No. 3, p. 127.) From 1st May 1948 standard frequencies of 440 and 1 000 c/s, of quartz-clock accuracy, will be radiated between 10 30 and 10 40 each Monday by every transmitter of the North-West Germany broadcasting station. The following transmission frequencies will be used: 904 kc/s (331.9 m), 1 330 kc/s (225.6 m) and 6 115 kc/s (49.08 m).

621.317.332 **3453**

Absolute Measurement of the Time Constant of Resistors.—J. W. L. Köhler & C. G. Koops. (*Philips Res. Rep.*, Dec. 1947, Vol. 2, No. 6, pp. 454–467.) A new method in which standard capacitors with negligible losses are used as reference standards.

621.317.361.029.64+621.317.763.029.64 **3454**

Contribution to the Study of Methods and Apparatus for Measurements in the Centimetre Wave Band : Part 2.—M. Denis & R. Liot. (*Ann. Radioélect.*, July 1948, Vol. 3, No. 13, pp. 189–213.) A detailed account of methods for the measurement of frequencies and frequency variations, with particular reference to wavemeters of the cavity-resonator type and their best operating conditions. The determination of the modulation characteristics of cm-λ generators is discussed ; this illustrates the qualities which precision wavemeters should possess and also the limits of their usefulness. Part 1 : 1076 of April.

621.317.44 **3455**

The Development of a Magnetic Testing Apparatus to Determine Iron Loss at High Flux Densities.—W. Cormack. (*Trans. S. Afr. Inst. elect. Engrs*, Oct. 1947, Vol. 38, Part 10, pp. 257–299. Discussion, pp. 299–300.) Limitations of routine test methods at flux densities approaching 20 000 lines/cm^2 are discussed. The main problem is found to be that of producing a voltage whose harmonic content can be varied so as to produce a sinusoidal flux wave in the test specimen under all conditions. The design of suitable equipment is considered. Using a c.r.o. as a phase indicator, values of B_{max} can be measured to an accuracy within 1%, and losses within 5%.

621.317.715 **3456**

Moving-Coil Galvanometers of Short Period and their Amplification.—A. V. Hill. (*J. sci. Instrum.*, Aug. 1948, Vol. 25, No. 8, p. 284.) Discussion of performance records of one of the galvanometers considered in 3174 of November (Downing) and 3175 of November (Hill).

621.317.715 **3457**

Investigation and Improvement of the Vibration Galvanometer.—G. von Mayrhauser. (*Z. angew. Phys.*, March 1948, Vol. 1, No. 2, pp. 68–75.) The use of ‘ koerzit ’ steel for the magnetic needle of a galvanometer of the frequency-independent type developed by Meissner & Adelsberger (1930 Abstracts, p. 405) gives a considerable increase of sensitivity and broadens the frequency-independent zone. A sharp minimum in the current/sensitivity curve due to mechanical coupling is investigated theoretically ; calculations are in good agreement with observations.

621.317.723 : 621.385.5 **3458**

H.F. Pentodes in Electrometer Circuits.—Crawford. (*See* 3557.)

621.317.729 **3459**

An Electrolytic Tank for Exploring Potential Field Distributions.—R. Makar, A. R. Boothroyd & E. C. Cherry. (*Nature, Lond.*, 29th May 1948, Vol. 161, No. 4100, pp. 845–846.) When using a.c., polarization and corrosion of the electrodes cause difficulties which are greatly reduced when the operating frequency is raised. Accurate results are obtained at 1 000 c/s with electrodes 0.5 mm in diameter, provided the electrode current density is not greater than 0.3 mA/mm^2. Copper-plated steel sewing needles make suitable electrodes.

621.317.73 **3460**

Radio-Frequency Resistance Meter.—H. W. Kline. (*Gen. elect. Rev.*, June 1948, Vol. 51, No. 6, pp. 25–30.) An instrument for determining r.f. resistance from the scale readings of a meter rather than as the ratio of reactance to resistance. A circuit diagram, photographs, and an abac for quick calculations are given. Applications are discussed.

621.317.73 **3461**

New Measuring Circuit for Conductance Meter.—W. A. McCool. (*Tele-Tech*, June 1948, Vol. 7, No. 6, pp. 30–31, 48.) Full circuit details of an instrument for measurement at 1 Mc/s of r.f. losses in high-quality insulating materials. A diode conductance circuit is used, with a sensitive differential voltmeter which enables the resonance voltage to be maintained accurately constant during a measurement.

621.317.733 **3462**

A Schering Bridge for Testing Insulating Materials.—R. J. Stanley. (*Muirhead Technique*, July 1948, Vol. 2, No. 3, pp. 20–23.) Details of the Type D-98-A bridge and Type D-99-A Wagner earth. Optimum performance is at frequencies of the order of 1 kc/s but good results can be obtained from 200 c/s to 10 kc/s. Possible errors are within 5% for both power factor and dielectric constant.

621.317.761 **3463**

Comparison of Neighbouring Frequencies by Counting Beats.—R. Sewig. (*Z. angew. Phys.*, March 1948, Vol. 1, No. 2, pp. 49–50.) Description of a ‘ phase filter ’, with which two frequencies in the range 50 c/s–100 kc/s can be accurately compared. Provision is made for recording the beat frequency and indicating the direction of drift of one frequency no matter how often the beat frequency becomes zero.

621.317.763 **3464**

An Absorption Wavemeter for the Decimetre Region.—D. G. Reid & J. K. Garlick. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 14, pp. 603–604 ; summary, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 106.) A coaxial-line instrument, with two fixed conductors and a sliding conductor of intermediate diameter. Resonance is indicated by a microammeter operated from a crystal rectifier. Construction details are given for a model for the frequency range 470–500 Mc/s, reading to ± 0.5 Mc/s. Silver plating increases the Q factor considerably.

621.317.763 **3465**

A New Wavemeter for Centimetre Waves.—N. N. Malov. (*Zh. tekh. Fiz.*, June 1948, Vol. 18, No. 6, pp. 793–798. In Russian.) A high-accuracy narrow-band wavemeter consisting of a waveguide of variable cross-section and filled with two different dielectrics.

621.317.784.088 **3466**

Some Sources of Error in Microwave Milliwattmeters.—G. F. Gainsborough. (*J. Instn elect. Engrs*, Part III, July 1948, Vol. 95, No. 36, pp. 229–238.) An approximate analysis of the factors that influence the intrinsic accuracy of a heated filament used for measuring power. Instruments incorporating such filaments are usually subject to significant errors if the filaments are longer than about $\lambda/10$. The errors are usually smaller in resistance milliwattmeters than in thermocouple instruments used similarly. Additional serious errors can be caused by the inefficiency of the transformer used to match the power source to the filament of the instrument. Filament instruments cannot in their present state of development be relied on as standard transfer instruments for measuring microwave power in terms of l.f. calibration.

621.317.79 : 534.851 : 621.395.813 **3467**

New Circuit Design for Wow Tester.—M. G. Nicholson. (*Tele-Tech*, June 1948, Vol. 7, No. 6, pp. 26–29..63.) Equipment for the measurement of frequency variations of 0.5–40 c/s, and also amplitude variations up to 25% at any variation rate from 0.5 to 40 c/s. Such amplitude variations may be caused in magnetic wire reproducers if the wire is not continuously in contact with the reproducing head. Recording milliammeters and c.r.o. attachments enable graphs and oscillograms of the quantities in question to be obtained.

621.317.79 : 621.392.029.64 **3468**

The Design of Precision Standing-Wave Indicators for Measurements in Waveguides.—D. Hirst & R. W. Hogg. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 14, pp. 589–595; summary, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 114.) Slotted-section indicators for H_{10} waves in rectangular waveguides are considered. Requirements for precision measurement are summarized, and methods of obtaining the necessary mechanical accuracy are discussed. Mechanical rigidity and first-class workmanship are essential. The design of a detector-matching system using a coaxial line is described, and the various available types of detector are compared. Methods are given for checking the accuracy of construction and for calibrating the detector. A detailed illustrated description is given of typical equipment for the 10-cm and 3-cm wavelength bands.

621.317.79 : 621.396.615 : 621.397.62.001.4 **3469**

Picture-Modulated Television Signal Generator.—A. Easton. (*Electronics*, Aug. 1948, Vol. 21, No. 8, pp. 110–115.) For production testing of receivers at points remote from television transmitting stations. Circuit and performance details are given. A mixing pad permits the combination of picture, sound and noise signals.

621.317.79 : 621.396.621.54.001.4 **3470**

The Testing of Communication-Type Radio Receivers.—W. J. Bray & W. R. H. Lowry. (*J. Instn elect. Engrs*, Part III, July 1948, Vol. 95, No. 36, pp. 271–276.) Discussion on 2298 of August.

621.317.79 : 621.396.645 **3471**

A Practical Gain Set.—C. G. McProud. (*Audio Engng, N.Y.*, May 1948, Vol. 32, No. 5, pp. 20–23.) Design and construction details of a simple instrument.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

534.321.9.001.8 **3472**

Ultrasonics Research and the Properties of Matter.—Kittel. (*See* 3300.)

535.61-15 **3473**

Development in the Infra-Red Region of the Spectrum.—G. B. B. M. Sutherland & E. Lee. (*Rep. Progr. Phys.*, 1946/1947, Vol. 11, pp. 144–175. Bibliography, pp. 175–177.) Developments in detectors are first reviewed, the frequency-selective types (photographic, phosphor, photoemissive, photoconductive and photovoltaic) and non-selective types (thermoelectric, bolometric, pneumatic, radiometric, evaporographic and convective) being considered separately. Improvements in filters and in dispersive and window materials are described. Recent applications and possible future developments, particularly spectroscopic, are discussed.

539.16.08 **3474**

Studies on Helium-Filled Geiger Müller Counters.—H. R. Sarna, P. L. Kapur & Charanjit. (*Proc. nat. Inst. Sci. India*, 18th Aug. 1942, Vol. 8, No. 2, pp. 277–287.) Experiments with tubes filled with a mixture of He and alcohol vapour showed that methyl and ethyl alcohols are the most suitable. Optimum results are obtained for alcohol partial pressures of 2.5–3.0 cm Hg.

539.16.08 : 537.533.9 : 549.211 **3475**

Remarks on Diamond Crystal Counters.—Lonsdale. (*See* 3399.)

550.837.7 : 621.3.091 : 553.57 **3476**

The Attenuation of Ultra-High Frequency Electromagnetic Radiation by Rocks.—R. I. B. Cooper. (*Proc. phys. Soc.*, 1st July 1948, Vol. 61, No. 343, pp. 40–47.) The attenuation of 200-Mc/s signals in dry sandstone was found to be 3 to 4 db/foot.

621.318.572 : 518.5 **3477**

Megacycle Stepping Counter.—C. B. Leslie. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1948, Vol. 36, No. 8, pp. 1030–1034.) Development and general construction are described with special reference to the input-pulse commutator and the method of interstage coupling. Application to electronic digital computers is also considered.

621.38.001.8 : 522.6 **3478**

Electronics in Astronomy.—G. E. Kron. (*Electronics*, Aug. 1948, Vol. 21, No. 8, pp. 98–103.) Discussion of accurate time-keeping devices, automatic aids to the precise tracking of telescopes, and photoelectric photometers.

621.38.001.8 : 771.36.001.4 **3479**

Testing Photographic Shutters.—S. H. Duffield & L. R. Lankes. (*Electronics*, Aug. 1948, Vol. 21, No. 8, pp. 82–87.) A review of the basic circuits used in electronic testers.

621.384.6 **3480**

Some High-Frequency Measurements on a Cyclotron Model.—G. Lindström. (*Ark. Mat. Astr. Fys.*, 18th June 1948, Vol. 35, Part 2, Section A, No. 15, 10 pp. In English.) An account of measurements of dee-voltage variations for a 1 : 10 scale model of the complete h.f. system of the cyclotron under construction at the Nobel Institute of Physics, Stockholm; the frequency was correspondingly increased.

621.384.6 **3481**

A Note on the Shape of the Polepieces of a Synchrotron Magnet.—N. Davy. (*Proc. phys. Soc.*, 1st June 1948, Vol. 60, No. 342, pp. 598–599.) The shape of polepieces giving the required field variation is deduced by treating the problem as two-dimensional and using conformal transformations.

621.384.6 **3482**

A 16-MeV Betatron.—K. J. R. Wilkinson, J. L. Tuck & R. S. Rettie. (*Nature, Lond.*, 27th March 1948, Vol. 161, No. 4091, pp. 472–473.) The betatron weighs 0.85 ton, operates at 50 c/s and requires 4 kW input power. The limited orbit space requires high uniformity in the field around the orbit.

621.384.6 : 621.319.339 **3483**

Electrostatic Generators for the Acceleration of Charged Particles.—R. J. Van de Graaff, J. G. Trump & W. W. Buechner. (*Rep. Progr. Phys.*, 1946/1947, Vol. 11, pp. 1–17. Bibliography, pp. 17–18.) Discussion of the endless-belt type of generator and the methods of applying the potentials to accelerating tubes. Particular attention is paid to the design of the belt system, insulation problems, and the construction of multiple-electrode tubes. Voltage measurement and stabilization are considered briefly.

621.385.833 **3484**

Electron Optics.—L. de Broglie. (*Bull. Soc. franç. Élect.*, June 1948, Vol. 8, No. 82, pp. 292–300.) Theory of the formation of images in ordinary optical and in electron instruments is reviewed; the resolving power of electron microscopes is discussed in relation to the theories of Heisenberg.

621.386.1 **3485**

On a New Type of Rotating-Anode X-Ray Tube.—A. Taylor. (*Proc. phys. Soc.*, 1st July 1948, Vol. 61, No. 343, pp. 86–94.) Description of the 'Peristron', a water-cooled tube without rotary vacuum seals.

629.13.053.2 **3486**

Sonic True Air Speed and Mach Number Indicator.—V. B. Corey. (*J. acoust. Soc. Amer.*, July 1948, Vol. 20, No. 4, pp. 583–584.) Summary only. A practical instrument in which the extension of a servo-controlled movable beam, carrying an acoustic transmitter, indicates the true air-speed. The basic principles of the instrument could be used to measure the speed of a body moving in any fluid of low viscosity. See also 2883 of October (Hoather).

PROPAGATION OF WAVES

538.566 **3487**

The Application of a Variational Method to the Calculation of Radio Wave Propagation Curves for an Arbitrary Refractive Index Profile in the Atmosphere.—G. G. Macfarlane. (*Proc. phys. Soc.*, 1st July 1948, Vol. 61, No. 343, pp. 48–59.) An analysis is given of the propagation of radio waves through an atmosphere in which the variation of the modified refractive index with height can be represented by a linear term together with one or more exponential terms. Two examples are given, corresponding to a surface duct and an elevated duct respectively, and a practical height-gain curve measured for λ 3 m is shown to be in good agreement with that derived theoretically from the refractive-index gradient. See also 2892 of 1947 (Booker & Walkinshaw).

621.396.11 + 538.566 **3488**

The Velocity of Propagation of Electromagnetic Waves derived from the Resonant Frequencies of a Cylindrical Cavity Resonator.—L. Essen & A. C. Gordon-Smith. (*Proc. roy. Soc. A*, 2nd Sept. 1948, Vol. 194, No. 1038, pp. 348–361.) Full account of the work noted in 3249 of 1947. Final measurements gave the velocity as 299 792 km/s. The estimated maximum error in this result is 9 km/s.

621.396.11 **3489**

Propagation of a Direct Wave around the Earth taking into account Diffraction and Refraction.—V. A. Fock. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, March/April 1948, Vol. 12, No. 2, pp. 81–97. In Russian.) Assuming uniformity of the surface of the earth, the propagation of radio waves is determined by diffraction around the curved surface of the earth, refraction in the lower layers of the atmosphere and reflection from the ionosphere. For ranges over 1 000 km the third factor predominates, but it is still possible, under certain conditions, to separate and observe the direct (diffraction) wave. Its study is of great importance for distance ranging by interference methods.

A theory of the direct wave is given and a solution of the Maxwell equations for the Hertzian vector is found in which diffraction and refraction are both taken into account. The conception of an equivalent radius of the earth is examined and conditions under which its use is justified are established. It is shown that this conception can be used for regions of shadow and semi-shadow, where the methods of geometrical optics are not applicable.

621.396.11 **3490**

Radio Shadow Effects Produced in the Atmosphere by [temperature] **Inversions.**—W. L. Price. (*Proc. phys. Soc.*, 1st July 1948, Vol. 61, No. 343, pp. 59–78.) The meteorological conditions described by Booker (516 of 1947) enable radar sets to detect objects at very large ranges. The possibility that these long ranges are associated with 'shadow' zones in which an aircraft would not be detected is here investigated theoretically by ray-tracing methods. Controlled experiments, in which measurements of all the relevant physical conditions were made, show that these shadow zones do exist above certain temperature inversions, and that their position and extent agree well with theory. See also 2892 of 1947 (Booker & Walkinshaw).

621.396.11 **3491**

The Elements of Wave Propagation using the Impedance Concept.—H. G. Booker. (*J. Instn elect. Engrs*, Part III, May 1948, Vol. 95, No. 35, pp. 203–204.) Discussion on 3250 of 1947.

621.396.11 : 535.3 **3492**

Intensity-Distance Law of Radiation.—H. R. L. Lamont & J. A. Saxton. (*Wireless Engr*, Aug. 1948, Vol. 25, No. 299, p. 269.) A value $d^2/8\lambda$ is suggested for the critical distance parameter r_0 dividing the optical case from the radio case; this is much smaller than Bell's value $d^2/0.52\lambda$ (2592 of September). The value $d^2/8\lambda$ is based on practical results obtained for λ 3 cm and λ 9 cm; the inverse square law is found to hold at ranges $>4r_0$, when the path difference between rays arriving from the edge and centre of the aperture is not greater than $\lambda/4$, if the phase of the radiation is uniform over the aperture.

621.396.11 : 551.510.535 **3493**

Equivalent Path and Absorption for Oblique Incidence on a Curved Ionospheric Region.—J. C. Jaeger. (*Proc. phys. Soc.*, 1st July 1948, Vol. 61, No. 343, pp. 78–86.) A Chapman distribution of ionization density is assumed. The absorption, the equivalent path, and the projection of the path on the earth's surface may all be expressed by equivalence theorems of the plane-earth type with suitably modified parameters and functions. Numerical values of the functions involved are given. See also 3252 of 1947.

621.396.11 : 551.510.535 **3494**

On the Localization of the Sporadic-E Ionized Region of the Upper Atmosphere.—Revirieux : Lejay. (*See* 3410.)

621.396.11.029.58 **3495**

Investigations of High-Frequency Echoes.—H. A. Hess. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1948, Vol. 36, No. 8, pp. 981–992.) See also 3214–3216 of November and 3496 below.

621.396.11.029.58 **3496**

Short-Wave Echoes.—H. A. Hess. (*Funk u. Ton*, July 1948, Vol. 2, No. 7, pp. 334–344.) Continuation of 2053 of July. The results of observations for frequencies of 10–20 Mc/s during 1941–1945 are summarized and discussed. The time *t* for a complete circuit of the earth varied between 0.137 60 and 0.138 05 sec, the mean value being 0.137 78 sec. No dependence of *t* on either frequency, time of day, or season of year was found, but the frequency range for echo signals increased towards the period of sunspot maximum, for which it was 15–30 Mc/s. Comparison of the amplitudes of direct and reverse signals, and single- and multicircuit signals, showed on the average a field strength decreasing linearly with distance. Multipath effects were noted for the main signal of high-power transmitters when the transmission path was $< 1\,000$ km; the time delays of the interfering signals may be several milliseconds. Split signals and the Doppler effect are discussed and a possible explanation is suggested for the fading-out of the reverse signal which is mainly observed during summer nights. The results in general favour a tangential propagation path above the E-layer. See also 3214–3216 of November and 3495 above.

621.396.11.029.62 : 621.396.932 **3497**

V.H.F. Cross-Channel Communication.—N. Levin, A. G. D. Watson, G. Hanson, G. W. Parks & D. A. Cobb. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 14, pp. 663–665; summary, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 131.) Propagation conditions between the Isle of Wight and Normandy at frequencies between 85 and 95 Mc/s had to be determined for designing reliable communication equipment for D-day. Transmitter height would be about 700 ft, receiver height 50 ft; the maximum range required was 83 sea miles and the optical range was about 36 sea miles. Crystal-controlled transmitters and receivers were to be used, the transmitted power being 100 W and the receiver sensitivity 6.0 μV input for 20 db signal/noise ratio. Propagation tests were undertaken over paths off the Cornish and Welsh coasts. The results are discussed; it was predicted that a 20-db signal/noise ratio could be expected over the operational path for 60% of the time. The operational network which actually provided almost continuous service is described.

621.396.11 **3498**

Elementary Manual of Radio Propagation. [Book Review]—D. H. Menzel. Prentice-Hall, New York, 1948, 220 pp., $7.65. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1948, Vol. 36, No. 8, p. 1009.) Graphical methods of calculating field strength are included for various conditions of distance, time, frequency, geographical location and topography. The treatment of the frequency range 3–30 Mc/s is particularly comprehensive.

RECEPTION

621.396.621 **3499**

On the Selectivity of Broadcast Receivers.—W. Kleinsteuber & G. Riese. (*Funk u. Ton*, July 1948, Vol. 2, No. 7, pp. 327–333.) Consideration of the possibility of cutting out the reception of a powerful station, particularly a local station. Curves are given showing the frequency limits within which this is practicable for single and 2-stage circuits. The selectivity of two simple circuits coupled by a valve is compared with that of a band-pass filter.

621.396.621 : 621.396.619.11 **3500**

The Synchrodyne.—"Cathode Ray". (*Wireless World*, Aug. 1948, Vol. 54, No. 8, pp. 277–281.) A simple explanation of its basic principles. See also 1139 of April and back references.

621.396.621.54 **3501**

The Theory of the Super-Regenerative Receiver Operated in the Linear Mode.—G. G. Macfarlane & J. R. Whitehead. (*J. Instn elect. Engrs*, Part III, May 1948, Vol. 95, No. 35, pp. 143–157; summary, *ibid.*, Part I, May 1948, Vol. 95, No. 89, p. 233.) Formulae are derived for the properties of the receiver in two states of operation corresponding roughly to sinusoidal and rectangular wave quench. It is predicted and confirmed by experiment that the frequency response and the envelope of the output oscillations of such a receiver will each have the shape of a Gaussian error curve. A theory is given according to which the whole of the noise energy collected by the r.f. acceptance band of the receiver goes to produce noise in a bandwidth equal to half the quench frequency in the receiver output. The effect of further decreasing the post-detector bandwidth is also considered.

621.396.621.54 **3502**

Tracking in the Superheterodyne.—K. Pfeil. (*Funk u. Ton*, July 1948, Vol. 2, No. 7, pp. 358–370.) Design formulae are derived for the values of L and C for the various circuits of a superheterodyne, with numerical examples and also curves and tables of correction terms which greatly simplify calculation.

621.396.662 : 621.396.62 **3503**

Tuning Devices for Broadcast Receivers.—R. C. G. Williams. (*J. Instn elect. Engrs*, Part III, July 1948, Vol. 95, No. 36, pp. 240–241.) Discussion on 1194 of 1947.

621.396.821 : 551.594.6 **3504**

Variation, with Wavelength, of the Range of Atmospherics and of the Impulsive Flux per Metre corresponding to the Threshold of Operation of Receiver-Recorders of the Mean Level.—F. Carbenay. (*C. R. Acad. Sci., Paris*, 5th July 1948, Vol. 227, No. 1, pp. 51–52.) Measurements with the recorders at the Laboratoire National de Radioélectricité, for λ 2–25 km, indicate that the impulsive flux varies approximately as the square of the range, which increases from about 1 000 km for λ 2 km to over 3 000 km for λ 25 km. See also 2902 of November.

621.396.822 : 621.3.015.33 : 621.396.619.13 **3505**

On the Calculation of Impulse-Noise Transients in Frequency-Modulation Receivers.—F. L. H. M. Stumpers. (*Philips Res. Rep.*, Dec. 1947, Vol. 2, No. 6, pp. 468–474.) The effect of such transients is calculated by means of a series expansion of the phase, the general term of which contains $[A(t)]^n$ when the amplitude $A(t)$ of the disturbance is smaller than that of the signal, and $[A(t)]^{-n}$ in the contrary case. The Laplace transform is used to calculate the effect in the filters. The large effect of phase opposition during the capture time is explained.

STATIONS AND COMMUNICATION SYSTEMS

621.396.41 **3506**

A Centimetre-Wavelength Beam Telephone.—D. G. Reid & J. K. Garlick. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 14, pp. 605–609; summary, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 114.) The principles of operation and some construction details of light-weight 3-cm equipment for optical paths up to about 10 miles. It can be used for bridging a gap in a telephone line. The transmitter valve also acts as the local oscillator for the receiver, making send/receive switching unnecessary. The aerial system is highly directional; this reduces the risk of interference or jamming. The input power of 100 W is obtained either from a.c. mains or from a 12-V battery.

621.396.41 : 621.396.619.16 **3507**

Methods and Equipment used in Pulse Multiplex Communication Systems.—G. Potier. (*Funk u. Ton*, June–Aug. 1948, Vol. 2, Nos. 6–8, pp. 273–284, 345–357 & 396–406.) Translation into German of paper abstracted in 4031 of 1947.

621.396.41 : 621.396.65 **3508**

Multiplex Radiotelephony Link between the Mainland and Corsica.—P. Rivère. (*Ann. Radioélect.*, July 1948, Vol. 3, No. 13, pp. 221–239.) The characteristics which a R/T link should possess are reviewed and the particular advantages of f.m. carrier-current systems are enumerated. Theoretical calculations of the performance of the link between Grasse and Calenzana (Corsica) are compared with the results obtained in practice. Favourable refraction conditions, combined with a lower noise figure than that expected on theoretical grounds, assure uninterrupted communication in spite of the fact that 55 km of the total distance of 205 km is beyond the optical range. A detailed description of the 12-channel equipment is given. The transmission frequency towards Corsica is 97 Mc/s and towards the mainland 107 Mc/s. Transmitter power at the base of the feeder is 100 W.

621.396.41.029.62 : 621.396.611.21 **3509**

Reference-Crystal-Controlled V.H.F. Equipment.—D. M. Heller & L. C. Stenning. (*J. Instn elect. Engrs*, Part III, May 1948, Vol. 95, No. 35, pp. 157–160.) Discussion on 2616 of September.

621.396.5 **3510**

Modern Single-Sideband Equipment of the Netherlands Postals Telephone and Telegraph.—C. T. F. van der Wyck. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1948, Vol. 36, No. 8, pp. 970–980.) For another account see 1158 of April.

621.396.61/.62 **3511**

Citizens Band Transceivers: Part 4.—W. B. Lurie. (*Electronics*, Aug. 1948, Vol. 21, No. 8, pp. 76–81.) Details of the modifications required to enable an i.f.f. [identification, friend or foe] transponder, type BC-645, to provide 2-way communication at 465 Mc/s for mobile and fixed stations. Field tests carried out over various types of terrain are discussed. For earlier parts see 2456 of September (Rowland) and back references.

621.396.619.13 **3512**

Frequency Modulation.—K. R. Sturley. (*J. Instn elect. Engrs*, Part III, May 1948, Vol. 95, No. 35, p. 142.) Discussion on 4047 of 1945.

621.396.619.13 : 621.396.41 **3513**

The Application of Frequency Modulation to V.H.F. Multi-Channel Radiotelephony.—J. H. H. Merriman & R. W. White. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 14, pp. 649–658; summary, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 131. Discussion, *ibid.*, Part III, July 1948, Vol. 95, No. 36, pp. 277–281.) The use of f.m. radio links to form part of a trunk telephone network is discussed. Up to twelve channels are provided, each of 4 kc/s bandwidth, in the range 60–108 kc/s; the carrier frequency is between 45 and 80 Mc/s, with ± 300 kc/s deviation. In general on optical paths the radiated power required is about 10 W, whereas 100 W would be required for a.m. The factors determining signal/noise ratio, distortion and interchannel crosstalk are discussed and results of trials carried out over optical and long non-optical paths are given.

621.396.65 **3514**

Ultra-High-Frequency Techniques applied to Mobile and Fixed Communication Services.—J. Thomson, J. D. Denly, I. J. Richmond, F. Pugliese & H. Borg. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 14, pp. 630–632.) Discussion on 2081 of July.

621.396.65 **3515**

Résumé of V.H.F. Point-to-Point Communication.—F. Hollinghurst & C. W. Sowton. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 14, pp. 669–672.) Discussion on 2080 of July.

621.396.65 **3516**

G.E. S-T [studio-transmitter] **Link Equipment.**—D. J. Nigg. (*FM & Televis.*, June 1948, Vol. 8, No. 6, pp. 32–35 . . 47.) Detailed description of Type BL-2-A f.m. broadcast equipment, designed specifically for relaying high-fidelity programmes, and consisting of transmitter, receiver, two identical high-gain aerials, and an external rack-mounted pre-emphasis unit. The transmitter output is 10 W and the carrier frequency range 920–960 Mc/s. See also 3250 of November (De Witt).

621.396.65 : 622.86 **3517**

Applicability of Radio to Emergency Mine Communications.—E. W. Felegy & E. J. Coggeshall. (*United States Bureau of Mines*, Report R.I. 4294, May 1948, 56 pp.) An account of experiments carried out in several different mines, using frequencies in the range 32–220 kc/s. Methods tried included (*a*) communication through the ground, (*b*) carrier-current communication over the power distribution system, and (*c*) inductive communication making use of telephone, signal, and power wires, or track lines, without direct connection. The results are summarized and discussed. See also 2367 of August.

621.396.65.029.62 **3518**

Choice of Frequency for V.H.F. Radio Links.—D. A. Bell. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 14, pp. 633–636; summary, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 131.) The main factors affecting the choice are: (*a*) rate of diffraction attenuation beyond the horizon, (*b*) acceptable amount of fading, (*c*) directional gain of aerials, (*d*) effective height of receiving aerials, and (*e*) freedom from mutual interference with distant channels using the same frequency.

621.396.65.029.64 : 621.396.96 **3519**

The Transmission of Radiolocation Displays by means of Microwave Linkage Systems.—L. W. Germany & D. I. Lawson. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 14, pp. 619–629.) An account of the development of two systems by which information can be transmitted by cm-λ links to remote p.p.i. and height/range displays. The first, which was operated over a distance of 16 miles, is fully described, with block diagrams. Signal/noise ratio was about 8 : 1. The second was not completed, but an account of the principles of the system is given. Four relay stations were intended to convey information over a total distance of about 120 miles.

621.396.676 : 621.396.93 **3520**

Common-Aerial Working for V.H.F. Communication.—A. G. D. Watson, J. H. Jones & D. L. Owen. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 14, pp. 644–648; summary, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 131.) To economize in the number of aerials required on board ship, a number of transmitters or receivers tuned to different frequencies use the same aerial. Each set is connected to the aerial through a filter which acts as a short-circuit at unwanted frequencies. To prevent the main feeder from being completely short-circuited, connectors approximately $\lambda/4$ long are inserted between each filter and the branch point. A brief theoretical treatment is given.

621.396.712 **3521**

Large [British s.w.] **Broadcasting Station.**—(*Elect. Rev., Lond.*, 25th June 1948, Vol. 142, No. 3683, pp. 993–997.) Short illustrated account of the B.B.C. overseas station at Skelton, Cumberland. The two sets of buildings are about 1½ miles apart, at opposite ends of an oval site covering 750 acres. The 51 aerial arrays are supported by 31 masts of heights from 200 to 350 ft. The equipment of one section, OSE8, was provided by the English Electric group of companies and includes six 100-kW Marconi transmitters. The equipment of OSE9 is similar to that of OSE8, but the transmitters were made by Standard Telephones and Cables. Transmissions are beamed to different parts of the world by the aid of 6 aerial-switching towers, which are remotely controlled. A general description is given of a transmitter unit and its associated power supplies. At slightly reduced power the combined maximum demand of the two sections is 5 400 kW, with a load factor of about 75%. With all transmitters operating, 1 500 kW is delivered to the aerial arrays.

621.396.712.2 **3522**

The Trend of Design of Broadcasting Control Rooms.—F. Williams. (*B.B.C. Quart.*, Oct. 1947, Vol. 2, No. 3, pp. 184–192.) A description of the pre-war system and the design for future B.B.C. installations. The continuity-suite system described by Wynn (4033 of 1947) was used extensively during the war and will be developed to provide the operator with up to 200 programme sources with 5-channel mixing. The present trend is for decentralization, leaving the control-room proper to handle only miscellaneous programmes.

621.396.72 : 621.3.029.62 **3523**

Hifam. E.H.F. [88-Mc/s] **Amplitude-Modulated Broadcasting in U.S.A.**—S. Tarzian. (*Wireless World*, Aug. 1948, Vol. 54, No. 8, pp. 297–298.) An account of results with an experimental a.m. transmitter. With an aerial height of 800 ft, power gain of 10, output of 200 W and using vertical polarization, the service area extended to a radius of 25 miles. Simple frequency converters can be used with standard broadcast-band receivers. Frequency stability of the local oscillator was obtained by using invar coils and capacitors with zero temperature-coefficient. Receivers are simpler and cheaper than for f.m. and a narrower band of frequencies is used.

621.396.932 : 621.396.11.029.62 **3524**

V.H.F. Cross-Channel Communication.—Levin, Watson, Hanson, Parks & Cobb. (*See* 3497.)

621.396.97 **3525**

The War-Time Activities of the Engineering Division of the B.B.C.—H. Bishop. (*J. Instn elect. Engrs*, Part II, July 1948, Vol. 95, No. 36, pp. 301–302.) Discussion on 2086 of July.

621.396.619.13 **3526**

FM Transmission and Reception. [Book Review]—J. F. Rider & S. D. Uslan. J. F. Rider, New York, 1948, 409 pp., $1.80. (*Electronics*, Aug. 1948, Vol. 21, No. 8, pp. 222, 224.) Most of the commercial broadcast types of f.m. transmitter are included, as well as some used in amateur and police radio work. Receivers, reactance valves, limiters, discriminators, locked oscillators and ratio detectors are described in detail. Aerial systems and servicing are also considered.

SUBSIDIARY APPARATUS

621.314.12 : 621.394/.396].66 **3527**

Amplifying Dynamos. The Amplidyne.—A. Valentin. (*Bull. Soc. franç. Élect.*, June 1948, Vol. 8, No. 82, pp. 304–328.) A comprehensive discussion of basic principles, different types of machine, and practical applications.

621.396.68 **3528**

Vibrator Power Packs.—D. A. Bell. (*Wireless World*, Aug. 1948, Vol. 54, No. 8, pp. 272–276.) The principles of design are considered, with reference to (*a*) the choice of the correct value for the 'timing' capacitance connected across the transformer secondary, (*b*) the operating conditions of the transformer iron and copper with square-wave currents, (*c*) the voltage regulation and (*d*) the suppression of radio interference.

621.396.682 : 621.316.722.1 **3529**

A D.C. Stabilized Power Supply of Low Impedance.—V. H. Attree. (*J. sci. Instrum.*, Aug. 1948, Vol. 25, No. 8, pp. 263–268.) The unit gives an output of 400 V for a load current of 0–90 mA, with a voltage variation of 200 mV. It consists of a full-wave rectifier with a single-stage π filter followed by a series power valve, the grid of which is driven from a single-valve d.c. amplifier coupled to the 400-V output. Design and operation details are given. The output impedance is $< 2\ \Omega$ at any frequency up to 10 kc/s.

TELEVISION AND PHOTOTELEGRAPHY

621.397.3 : 621.385.832 **3530**

Flying Spot Designed for Television Studio Scanning.—(*See* 3563.)

621.397.6 : 621.385.832 **3531**

New Tubes for Colour Television.—H. Gilloux. (*Radio franç.*, July/Aug. 1948, pp. 22–24.) An account of the construction and principles of the chromoscope. See also 2937 of October (Bronwell).

621.397.61 **3532**

TV Transmitter Design : Parts 2 & 3.—G. E. Hamilton. (*Communications*, June & July 1948, Vol. 28, Nos. 6 & 7, pp. 20–22, 29 & 10–13.) Discussion of modulated amplifiers, adjustment of video signal amplitude and of class-B linear amplifiers. To be continued. Part 1 : 2948 of October.

621.397.62 + 621.397.82 **3533**

The TV Receiver : Its Operation and Common Forms of Interference.—W. Brown. (*CQ*, July 1948, Vol. 4, No. 7, pp. 31–35 . . 91.) Discussion of the general circuit arrangements of television receivers, and particularly of the diagnosis of interference by studying the distortion of the screen picture.

621.397.62.001.4 : 621.317.79 : 621.396.615 **3534**

Picture-Modulated Television Signal Generator.—Easton. (*See* 3469.)

621.397.621 **3535**

Frame Deflector-Coil Efficiency.—W. T. Cocking. (*Wireless World*, Aug. 1948, Vol. 54, No. 8, pp. 289–292.) Some of the problems involved in the design of RC-fed deflector coils are discussed. Although the frame scan is mainly dependent on the coil resistance, both resistance (R) and inductance (L) are of importance during the fly-back period. The power supplied to the coil depends on I^2L and R/L. There is a direct relation between the input power from the valve and the coil power, provided the ratio of the coupling resistance (R_a) to the coil resistance has its optimum value. In practice the fly-back requirements set a minimum value to R_a and the optimum relation cannot always be realized. The relative merits of pentode and triode circuits for feeding the coil are discussed.

621.397.743 **3536**

Land-Line Technique for Television Outside Broadcasts.—H. B. Rantzen, A. R. A. Rendall & S. N. Watson. (*B.B.C. Quart.*, Oct. 1947, Vol. 2, No. 3, pp. 177–183.) By using transportable repeater stations at intervals of the order of 1 mile, ordinary telephone lines may be used to link up with exchanges in Central London where special 'television cable' is available. For comparatively long distances (>8 miles) this cable is usually coaxial, frequency translation being necessary to eliminate the effect of l.f. noise. For short distances twin cable is used, without frequency translation, although this makes equalization more difficult.

621.397.828 **3537**

You *Can* Live with Television !—H. M. Bach, Jr. (*CQ*, June & July 1948, Vol. 4, Nos. 6 & 7, pp. 33–37 . . 87 & 36–38 . . 90.) General discussion of television interference due to amateur transmissions, and of methods of eliminating such interference. See also 3538 below.

621.397.828 **3538**

TVI [television interference] **Corrective Measures.**—W. M. Scherer. (*CQ*, Aug. 1948, Vol. 4, No. 8, pp. 34–37 . . 90.) Practical methods for application to amateur transmitters. See also 3537 above.

TRANSMISSION

621.3.09 **3539**

Reducing Transmission Bandwidth.—R. S. Bailey & H. E. Singleton. (*Electronics*, Aug. 1948, Vol. 21, No. 8, pp. 107–109.) Pulse trains for two channels are superimposed and transmitted as one train at half the original pulse recurrence frequency : the two trains are separated at the receiver. The bandwidth reduction thus obtained is compared with that theoretically possible.

621.396.61 : 621.396.97 **3540**

The Design and Operation of High-Power Broadcast Transmitter Units with their Outputs combined in Parallel.—T. C. Macnamara, A. B. Howe & P. A. T. Bevan. (*J. Instn elect. Engrs*, Part III, May 1948, Vol. 95, No. 35, pp. 183–198. Discussion, pp. 198–202. Summary, *ibid.*, Part I, June 1948, Vol. 95, No. 90, pp. 269–272.) The method of ensuring equality of the r.f. output voltage and modulation amplitude of the separate transmitter units is described. The circuits for combining and matching a variable number of transmitters to a common load are detailed and special design features are discussed relating to the parallel operation of transmitters, including the principle of 'drive suppression' for protection purposes. The method, developed by the B.B.C., is used for the Droitwich medium-wave transmitter, the aerial input power of 400 kW being provided by two 200-kW units in parallel. An aerial power of 800 kW for the Ottringham long-wave station of the B.B.C. European service was obtained by means of four similar 200-kW units in parallel. The design of the modulated-amplifier output circuit, and of a r.f. impedance monitor for fault protection, are discussed in appendices.

621.396.619.13 **3541**

Energy Distribution in the Spectrum of a Frequency Modulated Wave : Part 2.—A. S. Gladwin. (*Phil. Mag.*, April 1947, Vol. 38, No. 279, pp. 229–251.) Continuation of 2182 of 1945. The energy distribution can be calculated approximately when the energy spectrum and the statistical time distribution of amplitude of the modulating wave are known. The modulating wave is replaced by a synthetic waveform with the same energy spectrum and time distribution of amplitude. The sideband spectrum can thus be calculated ; its asymptotic nature for very small or very large deviation ratios is demonstrated. For very small deviation ratios the shape of the sideband spectrum is determined wholly by the energy spectrum of the modulating wave, and for very large deviation ratios wholly by the time distribution of amplitude of the modulating wave. Examples of spectra for modulation by telephonic signals are given.

621.396.619.23 **3542**

Some Aspects of the Design of Balanced Rectifier Modulators for Precision Applications.—D. G. Tucker. (*J. Instn elect. Engrs*, Part III, May 1948, Vol. 95, No. 35, pp. 161–172.) The performance of ring and Cowan types of modulator is shown to depend on rectifier characteristics, the circuit impedance in which the modulator operates, the resistance of the carrier generator and the carrier voltage. The main features discussed are efficiency, stability, production of unwanted modulation products, impedance and carrier leak. The design of a ring modulator is described in which the input impedance remains relatively constant over the cycle of carrier voltage.

621.396.619.23 : 621.317.35 **3543**

The Effects of an Unwanted Signal Mixed with the Carrier Supply of Ring and Cowan Modulators.—D. G. Tucker. (*J. Instn elect. Engrs*, Part III, May 1948, Vol. 95, No. 35, pp. 173–176.) A frequency analysis of the modulating function is used to investigate modulator performance. It is concluded that, for both ring and Cowan modulators, the primary modulating effect is, in general, largely independent of the resistance of the circuit supplying the carrier. When the frequency of the input signal is equal to the carrier frequency, the output of the difference frequency between the carrier and unwanted signal is zero for an ideal modulator and increases as the resistance of the carrier-supply circuit is decreased.

621.397.61 **3544**

TV Transmitter Design : Parts 2 & 3.—Hamilton. (*See* 3532.)

621.396.61.029.64 + 621.392.029.64 **3545**

Microwave Transmission Design Data. [Book Review]—T. Moreno. McGraw-Hill, New York, 1948, 248 pp., $4.00. (*Electronics*, Aug. 1948, Vol. 21, No. 8, pp. 216, 218.) "The general topics covered are : transmission-line theory as applied to microwave components ; coaxial lines and flexible cables ; wave guides, giving practical design data for structures, bends, tees, transformers, obstacles, windows, and couplings ; wave guides filled with dielectric material both completely and partially; and cavity resonators."

VALVES AND THERMIONICS

537.58 : 621.385.1 **3546**

Space Charge Current Theory and the Mechanical Impulse of the Electrons.—Selényi. (*See* 3393.)

621.314.653 **3547**

The Ignitron Valve — Notes on Operation under Experimental Conditions.—H. de B. Knight. (*J. sci. Instrum.*, Aug. 1948, Vol. 25, No. 8, pp. 273–275.) Data for Type BK22 and Type BK24 ignitrons.

621.385.029.63/.64 **3548**

Effect of Passive Modes in Traveling-Wave Tubes.—J. R. Pierce. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1948, Vol. 36, No. 8, pp. 993–997.) As the beam current is increased, the local fields due to the bunched beam become appreciable in comparison with the fields propagated longitudinally. The effect is to reduce gain, to increase the electron speed for optimum gain, to introduce a lower limit to the range of electron speeds for which gain is obtained and to change the initial loss.

621.385.029.63/.64 **3549**

Field Theory of Traveling-Wave Tubes.—L. J. Chu & J. D. Jackson. (*Proc. Inst. Radio Engrs, W. & E.*, July 1948, Vol. 36, No. 7, pp. 853–863.) The problem of a helix-type travelling-wave amplifier is solved, under certain simplifying assumptions, as a boundary-value problem. The beam causes the normal mode to break up into three modes with different propagation characteristics. Over a finite range of electron velocities one of these waves has a negative attenuation; outside this range the propagation constants of all three waves are purely imaginary. Numerical examples for a specific valve show the effect of beam current and beam radius. The initial conditions, signal level and limiting efficiency are also investigated.

621.385.032.21 : [546.86 + 546.36 **3550**

Optical and Photoelectrical Properties of Antimony-Caesium Cathodes.—N. D. Morgulis, P. G. Borzyak & B. I. Dyatlovitskaya. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, March/April 1948, Vol. 12, No. 2, pp. 126–143. In Russian.)

621.385.032.216 : 537.533.8 **3551**

Electron Emission from Oxide-Coated Cathodes under Electron Bombardment.—T. J. Jones. (*Nature, Lond.*, 29th May 1948, Vol. 161, No. 4100, p. 846.) Results of experiments designed to throw light on the disagreement between the conclusions of Johnson (1482 of 1945, 281 & 282 of 1947) and those of Pomerantz (3107, 3467 & 3468 of 1946). The secondary-to-primary ratio δ_m was usually found to change in the lower part of the temperature range 20–850° C, but at the higher end all targets gave values between 5 and 10 independent of temperature; this is in general agreement with Johnson. The variations at the lower temperatures were found to be due to the resistance of the oxide coatings. No enhanced thermionic emission was observed and a possible explanation of this effect noted by the other workers is given.

621.385.1 **3552**

Applications and Mounting Details of Rimlock and Mazda-Medium Valves.—G. Giniaux. (*T.S.F. pour Tous*, April 1948, Vol. 24, No. 234, pp. 89–91.) Suitable output circuits are given and also a circuit diagram and response curve for a complete a.c./d.c. receiver using these valves. See also 2664 of September.

621.385.1 : 621.396.822 : 621.3.076.12 **3553**

Methods of Compensating the Various Actions of the Shot Effect in Valves and Connected Circuits.—Strutt & van der Ziel. (*See* 3358.)

621.385.2 **3554**

Total Emission Damping.—J. Thomson. (*Nature, Lond.*, 29th May 1948, Vol. 161, No. 4100, p. 847.) A mathematical analysis of the damping due to a non-conducting diode connected across a tuned circuit. It is assumed that all electrons are emitted with a constant speed at right angles to the cathode and are acted upon by a constant retarding field superimposed on the small alternating field. The results are in agreement with the measurements of other workers noted in 3109 of 1946 (Smyth), 3343 of 1947 (van der Ziel & Versnel) and 3344 of 1947 (van der Ziel).

621.385.3 **3555**

Positive-Grid Characteristics of a Triode.—G. W. Wood. (*Proc. Inst. Radio Engrs, W. & E.*, June 1948, Vol. 36, No. 6, pp. 804–808.) The Jaffé equation (see 2577 of 1944) for reduced current density in a diode is applicable to a triode with a positive grid. Although experimental conditions and electrode geometry differed from Jaffé's theoretical assumptions, the characteristics found for receiving triodes were in reasonable agreement with the theory.

621.385.3 : 621.396.813 **3556**

Microphonism in a Subminiature Triode.—V. W. Cohen & A. Bloom. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1948, Vol. 36, No. 8, pp. 1039–1048.) The simple theory of the symmetrical plane triode is applied to the calculation of the change in anode current as a function of motion of the grid and cathode. Experimental investigations to determine the mechanical origin of several different forms of microphony are also discussed.

621.385.5 : 621.317.723 **3557**

H.F. Pentodes in Electrometer Circuits.—K. D. E. Crawford. (*Electronic Engng*, July 1948, Vol. 20, No. 245, pp. 227–231.) Experimental investigation of the suitability of certain British valves. When the grid potential is made sufficiently negative to prevent electrons from actually reaching the grid, a current of the order of 10^{-10} A exists in the opposite direction. This current produces noticeable effects when grid leaks of 100 MΩ or more are used; its causes were investigated by Metcalfe & Thompson (1931 Abstracts, p. 98). Low anode voltage, anode current and heater voltage help to reduce this grid current. Special circuit arrangements to widen the limits of useful operation of the valves are discussed. For similar American work see 1673 of June (Nielsen).

621.385.83.032.29 **3558**

Electron Optics and Space Charge in Simple Emission Systems with Circular Symmetry.—O. Klemperer & B. J. Mayo. (*J. Instn elect. Engrs*, Part III, May 1948, Vol. 95, No. 35, pp. 135–141; summary, *ibid.*, Part I, June 1948, Vol. 95, No. 90, p. 273.) The properties of such systems depend largely on the spacings between the electrodes. For any grid–anode spacing there is a certain grid–cathode spacing for which the current density in the focused beam is a maximum. For this spacing, both the divergence and the spherical aberration of the emitted electron beam have minimum values. Discussion shows that a direct application of first-order optical laws does not explain the crossover in an electron gun.

621.385.831 : 621.318.25 **3559**

Demagnetising Valves.—W. Grey Walter, H. W. Shipton & W. J. Warren. (*Electronic Engng*, July 1948, Vol. 20, No. 245, p. 235.) When the input stages of high-gain balanced l.f. amplifiers, such as are used in biological research, are heated with raw a.c., there is a residual ripple. The magnetic component of this ripple can be eliminated by first demagnetizing the valves themselves in a decreasing a.c. field. Reduction of the e.s. component was discussed in 3478 of 1947 (Grey Walter & Brooks).

621.385.832 **3560**

Repeller Storage Tube.—H. Klemperer & J. T. de Bettencourt. (*Electronics*, Aug. 1948, Vol. 21, No. 8, pp. 104–106.) The tube possesses internal 'memory' and can discriminate between periodically recurring and new information, but charge leakage during the interval between scans makes this discrimination imperfect. The beam velocity is chosen to bring as many electrons to the bombarded surface as leave it on account of secondary emission. The potential of the beam trace on the storage surface is then governed by the potential of the collector grid. Output is considerably improved by applying a high negative bias to the repeller electrode, which is attached to the back of the insulating storage plate.

621.385.832 **3561**

More Cathode-Ray Tube Data.—D. W. Thomasson. (*Wireless World*, Aug. 1948, Vol. 54, No. 8, pp. 296–297.) Extension of the list noted in 1835 of June.

621.385.832 : 621.386 **3562**

New X-Ray Tube Magnifies 500 Times.—(*Electronic Industr.*, June 1948, Vol. 2, No. 6, p. 11.) The X-ray image on a fluorescent screen causes electrons to be emitted from an adjacent photoelectric surface. These electrons are accelerated and focused on a phosphor screen, giving an image $\frac{1}{8}$ of the original size but 500 times as bright. An optical system restores the image to its initial size.

621.385.832 : 621.397.3 **3563**

Flying Spot Designed for Television Studio Scanning.—(*Tele-Tech*, June 1948, Vol. 7, No. 6, pp. 42–43, 67.) Short account of the RCA Type 5W(P15) c.r. tube and its use for the television of test patterns, films or announcements.

621.396.615.141.2 **3564**

The Cavity Magnetron.—H. A. H. Boot & J. T. Randall. (*J. Instn elect. Engrs*, Part III, May 1948, Vol. 95, No. 35, pp. 130–134.) Discussion on 890 of March.

621.396.615.141.2 **3565**

The High-Power Pulsed Magnetron: A Review of Early Developments.—E. C. S. Megaw. (*J. Instn elect. Engrs*, Part III, May 1948, Vol. 95, No. 35, pp. 130–134.) Discussion on 891 of March.

621.396.615.141.2 **3566**

The High-Power Pulsed Magnetron. Development and Design for Radar Applications.—W. E. Willshaw, L. Rushforth, A. G. Stainsby, R. Latham, A. W. Balls & A. H. King. (*J. Instn elect. Engrs*, Part III, May 1948, Vol. 95, No. 35, pp. 130–134.) Discussion on 892 of March.

621.396.615.142.2 **3567**

An Analysis of Klystron Reflector Performance.—H. Motz. (*J. Instn elect. Engrs*, Part III, July 1948, Vol. 95, No. 36, pp. 295–301; summary, *ibid.*, Part I, Aug. 1948, Vol. 95, No. 92, pp. 362–363.) The e.s. potential distribution in the reflector space is calculated for three typical reflector designs, and the transit time for electrons moving along the tube axis is calculated as a function of the h.f. voltage picked up in the resonator gap. The bunching of electrons and the energy exchange between electrons and resonator are discussed in detail and it is shown that the valve characteristics may be correlated with reflector design. Off-axis electron paths are computed and the effect on the valve impedance of focusing by the reflector is considered.

621.396.615.142.2 : 537.291 : 537.525.92 **3568**

Influence of Space Charge on the Phase Focusing of Electron Beams.—J. Labus. (*Z. Naturf.*, Jan. 1948, Vol. 3a, No. 1, pp. 52–61.) An investigation as to whether the occurrence of charge concentration, or electron bunching, in valves of the klystron type, can be hindered by space charge effects and consequently by the repulsive forces between the electrons. Such forces are found to have no effect on the bunching. Because of the lengthened electron path time, the bunching is favoured by the use of a lower degree of modulation. If the space charge exceeds a critical value, neither charge nor current peaks can occur at the end of the drift space, however great the degree of modulation; the peaks recede into the drift space. Below this value of space charge the efficiency is 44%. With an infinitely short control space the theoretical efficiency may reach 58% but energy exchange within the drift space results in a value between 58% and 44% depending on the space charge.

621.385.1 : 621.396.97 **3569**

Daten, Kennlinien und Schaltungen der deutschen Rundfunkröhren und ausführliche Anwendungsbeispiele. (Data, Characteristics and Connections of German Broadcasting Valves, and Detailed Application Examples.) [Book Review]—F. Kunze. Funkschau-Vertrieb Wilhelm Wolf, Potsdam, 1947. (*Phys. Blätter*, 1948, Vol. 4, No. 3, p. 131.)

621.385.3.029.64 + 621.396.615.142.2 **3570**

Klystron and Microwave Triodes. [Book Review]—D. R. Hamilton, J. K. Knipp & J. B. H. Kuper (Eds). McGraw-Hill, New York, 1947, 533 pp., $7.50. (*Electronics*, Aug. 1948, Vol. 21, No. 8, pp. 214, 216.) Volume 7 of the M.I.T. Radiation Laboratory series. An advanced theoretical analysis, including second-order effects and large-signal conditions as well as the usual small-signal first-order theories. Descriptive material is perforce excluded.

MISCELLANEOUS

058 : 621.001 **3571**

Almanach des Sciences, 1948.—L. de Broglie (Ed.). This publication, noted in 2674 of September, can be obtained from: Éditions de Flore, 10, rue Jean-du-Bellay, Paris (IV^e).

06.064 Paris : 621.396/.397 **3572**

Radio and Television Salon at the Paris Fair (1st-17th May 1948).—(*Onde élect.*, July 1948, Vol. 28, No. 256, pp. 282–286.) A general account, discussing the special features of the receivers on view, tropicalization, models for export, miniature sets, electroacoustics, dielectric heating equipment, radar, marine depth-sounding recorder, and measurement apparatus.

06.064 Paris : 621.396 **3573**

Technical Novelties at the Paris Fair.—H. Gilloux. (*Radio franç.*, June 1948, pp. 4–8.) An illustrated account of selected exhibits, including receivers, radiograms, measuring equipment, etc.

53 Planck **3574**

Max Planck.—(*Phys. Blätter*, 1948, Vol. 4, No. 4, pp. 133–180.) Comprehensive accounts, by several authors, of Planck's life and work, with many tributes from friends and former pupils. See also 1841 of June and 2675 of September.

654.19(494) **3575**

Radio and the PTT.—W. Felix. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st June 1948, Vol. 26, No. 3, pp. 120–126. In German and French.) Discussion of the various activities of the Swiss PTT in the radio field.

ABSTRACTS AND REFERENCES INDEX

The Index to the Abstracts and References published throughout the year is in course of preparation and will, it is hoped, be available in February, price 2s. 8d. (including postage). As supplies are limited our Publishers ask us to stress the need for early application for copies.

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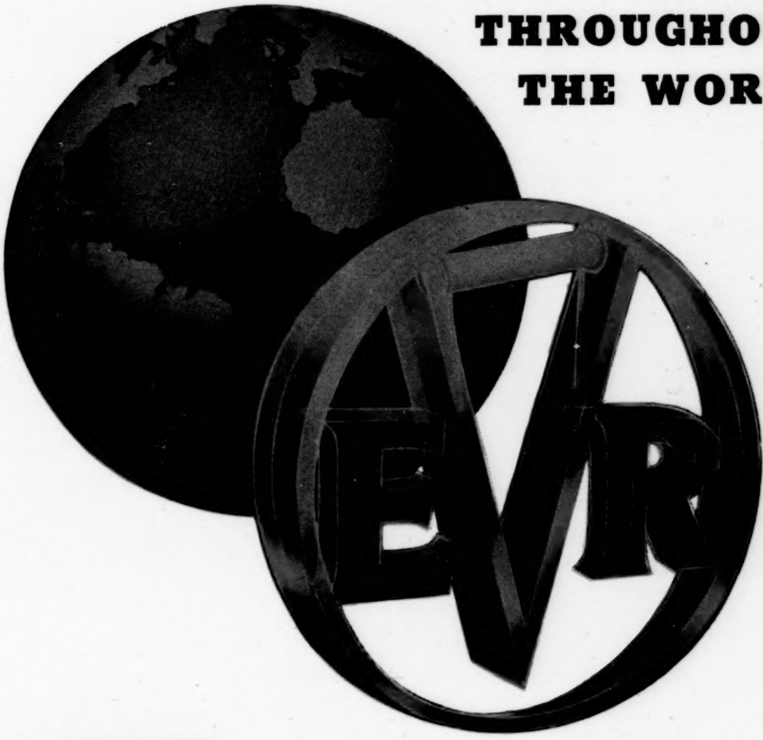

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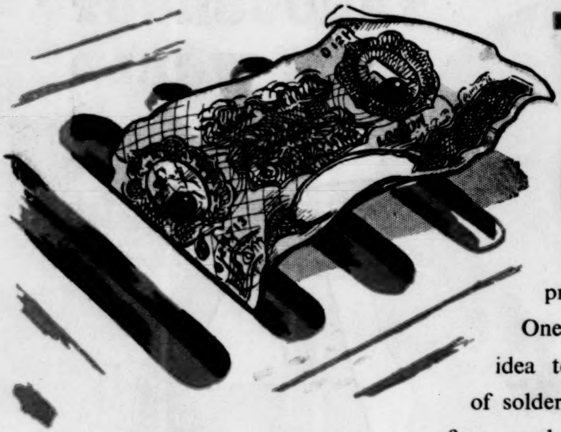

PARABLES FOR PRODUCTION MEN

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Once upon a time there was a man who prided himself on watching the pennies. One day, he decided it would be a good idea to "save a penny or two" on the cost of soldering the joints in the radio sets which his firm made. His production men told him that they were using the finest cored solder in the world; not being a technical chap, he reckoned that one solder was as good as another for "sticking bits of wire together," and so he bought a cheaper solder. On paper, he saved his firm a penny on every two sets they made. At that time he didn't know about things like "dry" or corroded joints. But he soon did. Soon, his firm started receiving complaints about "poor workmanship" (although the workmanship was the same as before; the only difference was in the solder). Sets started coming back, and when they looked into what was wrong, they found, of course, that the trouble was the joints. Either they were not joints at all, or the wires had corroded because there had not been any flux present in some of the solder, or the flux had been unreliable. It cost the firm many pounds to put things right — all because someone who ought to have known better tried to save on solder. He knows better now, anyway. The only solder you'll find in his works now is Ersin Multicore Solder, the three core solder wire which contains extra-active non-corrosive Ersin Flux, and guarantees freedom from "dry joints," elimination of waste, rapid melting and speedy precision soldering.

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